

A Comparative Study of Three Digital Libraries and Its Implication for National Development

Bamidele Oluwade
Department of Computer Science,
Faculty of Communication & Information Sciences, University of Ilorin, Ilorin, Kwara State,
Nigeria
Email: deleoluwade@yahoo.com
&
Sunday Atnadu Bawa
% Department of Library and Information Technology, Federal University of Technology,
Minna, Niger State,
Nigeria

ABSTRACT

The importance of digital libraries in this modern-day world is evident. These libraries provide easier access to library users. A digital library refers to a collection of organized electronic documents which are available on the Internet or on CD-ROM disks. In particular, a virtual library is a kind of digital library which provides portal to information that is available electronically elsewhere. In this paper, the differences and similarities in three digital libraries, located in two continents of the world (namely America and Africa) are identified. The specific libraries considered in America (USA) are the Library of Congress (LOC) (American memory online exhibit) and the Alexandria Digital Library (ADL), while the Nigerian Virtual Library (NVL) is the case study in Africa. A comparative analysis based on funding/support, architecture, content of collections and cost of access to resources was carried out. All the libraries are funded by the respective governments or their agencies. The study also shows that access to resources available in American memory online exhibit is free of charge. Access to resources available in ADL is not entirely free of charge, as registration is required for gaining access to some resources. Access to resources available on the NVL is also not free, as all users are to obtain their username and password from the authority. In the world ranking of libraries, LOC comes first while the ADL is next to LOC in ranking. Based on the findings in the paper, it is recommended that government and the public sector of Nigeria should create more awareness about the benefits of digital libraries. These benefits include speedy information retrieval in different electronic formats, reduction of mutilation and theft of library materials and sharing of resources between networked libraries). Affordable and easy access of modern information and communication technologies (computers, internet services) should also be provided for primary, secondary and tertiary institutions. These are the infrastructures on which digital libraries are designed.

Keywords: Digital Library, Library of Congress, Alexandria Digital Library, Nigerian Virtual Library, Architecture

African Journal of Computing & ICT Reference Format:

Bamidele Oluwade & Sunday Atnadu (2016), A Comparative Study of Three Digital Libraries and its Implication for National Development, *Afr. J. Comp. & ICT*, Vol. 9, Nos.1 & 2 (combined), pp. 54 - 65.

I. INTRODUCTION

There is no doubt that technology is greatly transforming libraries. The term “digital library” for example, is a relatively new term. Due to contrasting perspectives (research and practice), various definitions of the term now abound. It connotes different meanings to different communities viz. “electronic library”, “virtual library”, “universal library”, or “future library”. A digital library (DL) is viewed by some as an electronic database, and by others, as an institution that offers information services or service [1, 2].

The present paper promotes the view of a digital library as including electronic databases on the internet, the World Wide Web (WWW) and resources on compact disc read-only memory(s) (CD-ROMs) [3]. In this context the word “library” is a collection of full-text and bibliographic information sources rather than buildings that incorporate human services, such as electronic publishing, personal information management and distance education. Digital libraries have the potential of improving information retrieval and dissemination. A virtual library (VL) is a kind of digital library [4]. It provides portal to information which is available electronically elsewhere i.e. the library itself doesn’t hold any content. It only provides remote access to content which is available in libraries and other information sources, essentially online or via CD-ROM.

Many authors acknowledged that digital libraries, for example, the World Wide Web (WWW), hold more useful, up-to-date and relevant (to many subjects) information than most academic libraries and other categories of libraries have. Users whose computers are networked to a digital library from different locations, can access a single copy of an electronic journal. Copies of the same electronic journal can be downloaded in little or no time by users and the same electronic journal can be reformatted by users to suite individual reading needs, like making the font larger for those with limited sight, making the page fit a smaller screen etc. Also because readers get a screen display of the information contained in books, rather than carrying away the physical book, loss of books by theft, except for Compact disc-read only memory(s) CD-ROMs which are vulnerable, are much reduced.

It has been pointed out severally in the literature that digital libraries contain representations of original works, provides opportunities for students

and scholars to conduct research from personal computers and workstations located in their homes, offices and laboratories, and at their own pace and convenience. It also promotes scholarly publishing. In [5, 6], basic design principles and architecture of digital libraries were presented.

The aim of the present paper is to compare (American memory online exhibit of) the United States Library of Congress (LOC) [7], Alexandria Digital Library (ADL), USA [8] and the National Virtual Library of Nigeria (NVLN) of the National Universities Commission of Nigeria [9]. The parameters used in the comparison are architecture, funding/support, cost of access and content of collections. Earlier preliminary study on the theme was carried out by the second author under the supervision of the first author [10].

The LOC was established by an Act of Congress in 1800 when President John Adams signed a bill providing for the transfer of seat of government from Philadelphia to the new capital city of Washington. Established with \$5,000 appropriated by the legislation, the original library was housed in the new capitol until August 1814. In January 1815, congress accepted retired President Thomas Jefferson’s offer, appropriating \$23,950 for his books, and the foundation was laid for a great national library. The Jeffersonian concept of universality, the belief that all subjects are important to the library of the American legislature, is the philosophy and rationale behind the comprehensive collecting policies of today’s Library of Congress.

The LOC has made digitized version of collection materials available online since 1994, concentrating on its most rare collections and those unavailable anywhere else. The digital library services are the gateway to a growing treasury of digitized photographs, manuscripts, maps, sound recordings, motion pictures and books. In addition, the LOC maintains and promotes the use of digital library standards and provides online research and reference services. The LOC classification system, which uses alphabetic identifiers, has more classes than the Dewey classification system which uses decimal numbers as identifiers.

The Alexandria Digital Library project has its headquarters on the campus of the University of California at Santa Barbara, and it is hosted by the Davidson library. ADL is a consortium of researchers, developers and educators spanning the academic, public and private sectors, exploring a

variety of problems related to distributed digital libraries for geographically referenced information. By ‘distributed’, it is meant that the library holdings may be spread across the internet, as well as on a single personal computer. By ‘Geographically referenced’ is meant all the library holdings are associated with one or more regions (footprints) on the surface of the earth.

The National Virtual Library of Nigeria project was established in 2001 by the National Universities Commission (NUC). Bout ten years later, the project was rejuvenated via a subscription to thousands of e-books and e-journals in several fields of study. The goal is to improve the quality of teaching, learning and research in Nigerian institutions [11]. The website of the library was previously [12], a site which is now totally irrelevant. The new site is [9]. Virtual libraries of some individual Nigerian universities are hosted through the NUC virtual library (NUCVL). Apart from the NUCVL, other independent virtual libraries exist in the Nigerian system. These include the VL of the National Information Technology Development Agency (NITDA) [13], the Virtual Library Service of the National Library of Nigeria [14] and the virtual library of the Nigerian Institute of International Affairs [15].

II. TYPICAL ARCHITECTURE OF DIGITAL LIBRARIES

In general, a digital library may have multi-tier architecture and different digital libraries may have different architectures. The basic criteria for the development of a digital library system include [5] user friendliness, platform independence, scalability, technical simplicity, multi-ser in orientation and robust. Others include low cost, openness/interoperability, modularity and multimedia enablement [5, 16]. Figure 2.1 shows the major system components of a digital library.

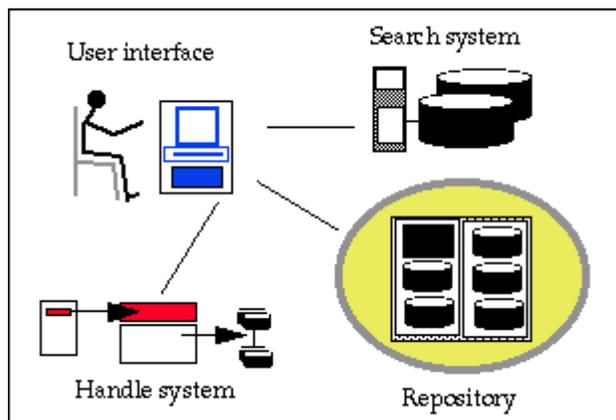


Figure 2.1: Major System Components of a Digital Library [5]

The basic components, as depicted in the figure are user interface, search system, handle system and repository. Two user interfaces (incorporating browsers) are used, namely end-user interface and interface for librarians and system administrators. A search system recognizes indexes and catalogs while handle systems are general purpose identifiers for internet resources. Repositories are components which store and manage digital objects and related information.

In terms of the architecture, digital libraries can be examined from the perspective of three levels, namely notional level, operational level and technical level [5]. The notional level (see Figure 2.2) involves the consideration of data and metadata. In particular, a metadata refers to a set of data which describes and provides information about other data. Operational level considers how information flow is managed through the system’s components while the technical level involves a consideration about the functional component.

DATA	METADATA
------	----------

Figure 2.2: Notional level of Digital Library Architecture.

Common categories of metadata include descriptive metadata (e.g. bibliographic information etc), structural metadata (information about formats and structures) and administrative metadata (such as rights, permissions and other information used to manage access).

2.1. LIBRARY OF CONGRESS

The architecture of the American memory online exhibit of the Library of Congress is in line with the general architecture shown in Figure 2.3. The constituents of this architecture include, among others, distributed libraries, web server, web cataloguing, external information system, digital audio and video capture and email system.

2.2. ALEXANDRIA DIGITAL LIBRARY

The Alexandria Digital Library (ADL) has a distributed service-based architecture with three basic layers. These are client, middleware and servers, as shown in Figure 2.4. It is both an online and offline based digital library.

There have been three distinct architectures associated with Alexandria digital library since the project's inception in 1994 [8]. The first was the "Rapid Prototype" architecture which used a personal computer (PC) geographic information system (GIS) as the user interface for accessing Alexandria digital library catalogue database. The second was the "Web Prototype" architecture which replaced the GIS with a server presenting a user-interface of dynamically generated hypertext markup language (HTML) pages. Like the pages accessible over the internet.

The third Alexandria digital library architecture is a generalization of the web prototype with interfaces supporting multiple clients and servers.

ADL servers are responsible for maintaining collections of metadata i.e. data about another data. ADL can also be used as an online catalogue for digital geospatial information. As such, ADL servers are generalizations of traditional library catalogues.

ADL clients are responsible for presenting ADL service to users. These users may be interactive (e.g. human beings using a graphical user interface) or may be programs using Alexandria digital library as a data source. The ADL clients also support complex real-time user interactions (e.g. rollover help etc). The very important aspect of the ADL architecture is the middle layer which maps an assortment of heterogeneous collection servers into a few standard client interfaces for metadata queries, metadata retrieval and digital holding retrieval. These client interfaces are intended to be generic enough to support clienteles.

2.3 NATIONAL VIRTUAL LIBRARY OF NIGERIA

The Nigerian Virtual Library as an online-based digital library whose architecture follows the general architecture of virtual digital library shown in Figure 2.5.

The architecture consists of several agents, namely user interface agent (for authors and consumers), referee agent, publisher agent, quantity agent, directory agent and information retrieval agent. All these are linked to the broker agent.

III. FUNDING AND COST OF ACCESS

3.1 LIBRARY OF CONGRESS

3.1.1 FUNDING/SUPPORT

Source of funding/support is from the government of United States of America.

3.1.2 ACCESS

Access to resources is free of charge, irrespective of whether the user is registered or not. Access is also not dependent on whether or not a prospective user is a United States citizen. Resources in text and image formats can be viewed, copied and manufactured for research purposes, except audio and video resources which are only accessible in read only formats due to copyright laws. If a user is not satisfied with offerings of the American memory online exhibit or has not been able to find what has been searched, such a user can use the "ask a librarian" hyperlink by click of the mouse button on the website [7] and there will be response from a reference librarian at the library of congress via electronic mail.

3.2 ALEXANDRIA DIGITAL LIBRARY

3.2.1 FUNDING/SUPPORT

The Alexandria Digital Library Project is one of the six projects funded under the Digital Libraries Initiative (DLI). The DLI is a joint program of the United States National Science Foundation (NSF), the Defense Advanced Research Projects Agency (DARPA) and the National Aeronautics and Space Administration (NASA) [17].

The name Alexandria comes from the Library of Alexandria, Egypt which was considered the centre of all knowledge/learning. The project began in 1994. The library of Alexandria per se was founded by Ptolemy I Sorter, King of Egypt, in the city of Alexandria and was

expanded by his son Ptolemy II Philadelphus early in the 3rd century BC.

3.2.2 ACCESS

Access to resources is not entirely free. A user must be registered to access some resources while some can be accessed without registration.

A user has to be registered to access some resources like the annex in the temple of Serapis which is 43,000 volumes, while others like audio books can be downloaded for free. If a user is not satisfied with offerings of the Alexandria digital library or has not been able to find search, such a user can use the “ask a reference question” hyperlink by click of the mouse button on the website (www.alexandriadigitallibrary.com) and there will be a response from a reference librarian at library of Alexandria via electronic mail.

3.3 NATIONAL VIRTUAL LIBRARY OF NIGERIA

3.3.1 FUNDING/SUPPORT

The Nigerian Virtual Library is a project supported by the Education Trust Fund (ETF)/Tertiary Education Trust Fund (TETFUND) of the Federal Government of Nigeria. It is managed by the National Universities Commission (NUC).

3.3.2 ACCESS

Access is not free. Only registered users can have access to resources. All users of the NVLN must request for their usernames and passwords. Users can no longer create passwords or usernames online as the case used to be.

IV. CONTENTS OF COLLECTIONS

4.1 LIBRARY OF CONGRESS

The Library of Congress contains over 100 million items, including several million books in about 500 languages. There is online access to over 500,000 items from its collections in the format of maps, atlases, printed and recorded music, motion pictures and television programmes. The American Memory Online exhibit includes a number of early films, television commercials and other moving image materials available for online viewing. The exhibits are in two groups: the first group of titles represent early motion picture history. The second group of titles contain titles that are protected by copyright.

American memory online exhibit provides one of the largest bodies of non-commercial high-quality content on the internet. By providing these materials online, potential users who may never come to Washington can gain access to the treasuries of the nation’s library. Such online access also help preserve rare materials that maybe too fragile to handle. In order to offer extensive reference service to the nation, and the world, the Library of Congress provides online access to over 500,000 items from its pictorial collections. The reproductions have sufficient quality to meet general reference needs, and, in a few instances, museum-quality facsimiles are also created.

The images in the Gottscho-Schleisner collection [18] grew out of a special project to make preservation copies of deteriorating nitrate and diacetate negatives in LOC photographic collections (some colour transparencies were also copied at this time). The original negatives were copied onto larger cut film in the late 1980s. At the same time, in order to produce a reference service video disc, the library of congress produced an additional 35mm film copy of the negatives. The contractor, stokes imaging of Austin, Texas produced the analogue videodisc from the 35mm film in a two-way process. First, stokes created a set of interim digital images with the moderate spatial resolution of 560 x 420 pixels. This set of digital images was achieved. Second, the digital images were processed to create the analogue video frames.

The current set of larger images (the images requested by the action of clicking the thumbnail) is reprocessed versions of the archived 560 x 420 digital images. The black and white images have a tonal resolution of 8 bits per pixel (256 shades of gray), while the colour images have a tonal resolution of 24 bits per pixel (16 million shades). All have been compressed with joint photographic experts group (JPEG) algorithm. Uncompressed versions of images at the same resolution are held by the library.

The “inline” thumbnail images for the Gottscho-Scheleiser collection are in Graphics interchange format (GIF) and have a tonal resolution of 8 bits per pixel. There are images displayed with the bibliographic records. It is an online based digital library.

The American memory online exhibit includes a number of early films, television commercials and other moving image materials available for online viewing. The exhibits are in two groups. The first group of titles represent early motion picture history. Majority of titles in group one are

public domain. The second group contains titles that are protected by copyright.

Some of the titles in group one include:

- a) America at work, America at leisure: motion picture from 1894-1915 [19].
- b) Origins of the American Animation, 1900-1921 [20].
- c) Theodore Roosevelt: his life and times on film, 1898-1919 [21].

Some of the titles in group two include:

- a) Fifty years of coca-cola television advertisements: highlights from motion picture archives at the library of congress between 1954 and 1999 [22].
- b) September 11, 2001 documentary project [23].

4.2. ALEXANDRIA DIGITAL LIBRARY

The collections in the Alexandria digital library include over 500,000 rolls of Ancient Egyptian history, annex in the temple of Serapis contained in 43,000 volumes. The library stores several articles, photographs and web links. It contains videos, compact discs, electronic resources, fiction for children, classic literature, bibliography and autobiography, business and carriers, foreign languages and free digital books software.

Books like “once upon a time in the north” a novel by Philip Pullman in audio format which can be downloaded for free and “sins of the assassin” a novel by Robert Ferrigno in audio format which can also be downloaded for free. Videos, of fiction for children and classic literature, bibliographies, business and carrier guidance, foreign language tutoring and free digital book software can be accessed. Search results (information) retrieved on collections of Alexandria digital library available on the internet using the Encarta premium digital versatile disk (DVD) 2008 was: 155 articles, 6 photographs and 28 web links.

4.3 NATIONAL VIRTUAL LIBRARY OF NIGERIA

Structure of access to collections in Nigerian Virtual Library is via creation of an account online and a password scheme (username and password) which can be obtained from the university librarian of a Nigerian university. Collections are arranged categorically and

alphabetically. The following are some examples: Agriculture/Veterinary Medicine, Arts/Humanities, Building and construction, Business/management studies, Education. etc.

Some of the Nigerian journals accessible are on the following topics: agriculture (e.g. agricultural economics, agricultural extension, agronomy (crop/soil) and fisheries), engineering (e.g. agricultural engineering), religion etc. The library stores several articles, photographs and web links.

V. DISCUSSION

The American memory online exhibit of the Library of Congress (LOC) is online based, so also is the National Virtual Library of Nigeria (NVLN). The Alexandria Digital Library (ADL), on the other hand, can run online and also on single desktop/laptop. However, the components on a single laptop are limited to only information available in the database. ADL has more of the ancient worlds in its collections. NVLN has substantial content relating to Africa and Nigeria in its collections. Access to resources on LOC is free of charge with download restrictions on audio and visual content due to copyright laws. Access to ADL is not entirely free as registration is required to access some resources. Access to the NVLN requires approval.

Scholarly and professional interest in digital libraries has grown rapidly throughout the 1990s [2]. As ongoing researches indicate [24], services provided by these libraries will continue to be improved upon. It is therefore important that Nigeria takes more steps to harness the opportunities that digital libraries offer. These include speedy information retrieval in different digital formats, reduction of information bulkiness leaving only the message part, reduction of mutilation and theft of library resources, and sharing of resources between networked libraries. The developed world has made headway in networked and digital library capabilities. The United States determination to harness the benefit of the digital libraries inspired the country to designing these libraries as “a national challenge application area” under the High Performance Computing and Communications Initiative (HPCC) and a key component of the National information infrastructure [2]. This has helped a lot in enhancing information services delivery. This example is worthy of emulation by Nigeria. Nigeria’s access to information is vital if Nigerians are to contribute in finding solutions to their own development problems.

In the library of the future, the virtual (digital) networked library, there are strong indications that collection and archiving will be less important, at each local library. With networked information, there is less need to store local copies, and there is a shift away from collections towards access. This might imply fewer libraries and less information in each library. Of course, other opportunities exist for a library to collect documents. Some suggest that collecting and publishing local unpublished information may be an important future role of libraries. Others see the library as the publisher of local research material, bypassing today's publishers. However, this will not produce the same volume of documents as today. When libraries do not collect as much, there is less need for local archiving. The task of archiving will probably be assumed by regional and national archives or libraries in each country.

It is hoped that there will be increased awareness, funding and support of digital library projects in Nigeria by government and the private sector of Nigeria.

It is recommended that:

- (i) There is need for more publications, such as books, theses and journals, published on digital libraries by Nigerian authors. This will showcase the benefits of digital libraries, which include speedy information retrieval in different electronic formats, reduction of mutilation and theft of library resources and sharing of resources between networked libraries.
- (ii) The emerging digital libraries in Nigeria such as National Virtual Library of Nigeria and MTN Virtual Library [25] should approach the presentation of knowledge contained in their collections by making available version of collections in English and indigenous languages, especially the three major languages in Nigeria, namely Igbo, Yoruba and Hausa.
- (iii) It has been said that a building of good architectural touch will naturally attract people to come and pay a visit to it. This is a call for refurbishment of some of the dilapidated traditional library buildings in Nigeria, by government and the private sector. This has the potential of influencing users to always return to the library for research in what is perceived as a comfortable environment.
- (iv) Digital libraries need to be integrated into traditional libraries to create hybrid libraries. This will mean that users no longer need to

concern themselves with the location, format or access method. That is, users can get whatever information they need at any time in a prompt manner, contrary to the usual phenomenon in a traditional library. This will help to revive the book reading culture in Nigeria.

- (v) The government of Nigeria need to make education a topmost priority of her development programmes by adequately allocating a substantial part of the national budget for education. Measures need to be put in place so that the allocation is judiciously spent. The government should also make available up-to-date educational and training facilities that will equip citizens to design, build, operate and maintain information and communication technologies (ICTs) infrastructure.
- (vi) The government and the private sector of Nigeria should not only create awareness, but should also provide affordable and easy access to modern information and communications technology (computers, internet services) for primary, secondary and tertiary institutions. This is the infrastructure on which virtual/digital libraries are based.

VI CONCLUSION

This paper carried out an examination of the differences and similarities in three digital libraries, namely, the American memory online exhibit of the United States Library of Congress, the Alexandria Digital Library, USA and the National Virtual Library of Nigeria. The comparison was based on funding/support, architecture, content of collections and cost of access. In the normal ranking of libraries, LOC comes first, based on several factors such as content. In particular, LOC is globally acknowledged, for instance, due to its superior classification scheme, over the popular Dewey Decimal Classification Scheme. The latter uses call numbers for book and non-book materials across the world. LOC scheme uses alphabetic identifiers. Based on the overall findings in this paper, the ADL is next to LOC in ranking.

REFERENCES

- [1]. Tony Feldman, Introduction to Digital Media. Routledge, London, 1997.
- [2] C. L. Borgman, 'What are Digital Libraries? Competing Visions, Information Processing and Management, 35, 227-243, 1999.
- [3] <https://whatis.techtarget.com/definition/digital-library> <last accessed in 2016>
- [4] Muttayya Koganuramath, 'Virtual Library: An Overview', 5th International CALIBER (Conference Proceedings), Panjab University, Chandigarh, 535-542, 2007.
- [5] Richa, Pandey, 'Digital Library Architecture', DRTC Workshop on Digital Libraries: Theory and Practice, DRTC, Bangalore, 2003; http://dlissu-pbworks.com/w/file/44829234/B_architecture.pdf <last accessed in 2016>
- [6] Sandip Das and M. Krishnamurty, 'Architectural Components of Digital Library: A Practical Example using DSpace' in Trends in Management of Academic Libraries in Digital Environment (TMALDEN-2014) (Conference Proceedings), 183-194, 2014; <http://eprints.rclis.org/28244/1/Dspace-Sandip.pdf> <last accessed in 2016>
- [7] <http://www.loc.gov>
- [8] <http://www.alexandria.ucsb.edu>
- [9] <http://www.nvl.edu.ng>
- [10] Sunday Atnadu Bawa, Comparative Study of Virtual/Digital Libraries in Global Organizations, B.Tech. Project Report, Department of Library and Information Technology, Federal University of Technology, Minna, Nigeria, 2008.
- [11] <https://nigeriacommunicationsweek.com/ng/nuc-spends-n500m-to-revive-virtual-library-project>, 2012
- [12] <http://www.nigerianvirtuallibrary.com>
- [13] <https://nitda.gov.ng/virtual-library>
- [14] <http://www.nln.gov.ng/open-dept?pgid=VLSD>
- [15] <http://www.niaa.gov.ng/virtual-library>
- [16] Hussein Suleman, 'Design and Architecture of Digital Libraries', http://pubs.cs.uct.za/archive/00000828/01/iai_2011_architecture.pdf <last accessed in 2016>
- [17] James Frew; Michael Freeston; Randall B; Jason Simpson; Terence Smith; Alex Wells and Qi Zheng, 'The Alexandria Digital Library Testbed', D-Lib Magazine, July/August 1996.
- [18] <https://www.loc.gov/collections/gottschoschleisner/about-this-collection>
- [19] <http://memory.loc.gov/ammem/awlhtml/awlhome.html>
- [20] <http://memory.loc.gov/ammem/oahtml/oaohome.html>
- [21] http://memory.loc.gov/ammem/collections/troosevelt_film
- [22] <http://memory.loc.gov/ammem/ccmhtml/colahome.html>
- [23] http://memory.loc.gov/ammem/collections/911_archive
- [24] H.M. Gladney and J.B. Lotspiech, 'Safeguarding Digital Library Contents and Users', D-Lib Magazine,

1997;

<http://www.dlib.org/dlib/may97/ibm/05gladney.html>

[25] <http://library.unn.edu.ng/2015/10/31/mtn-digital-library> <last accessed in 2016>

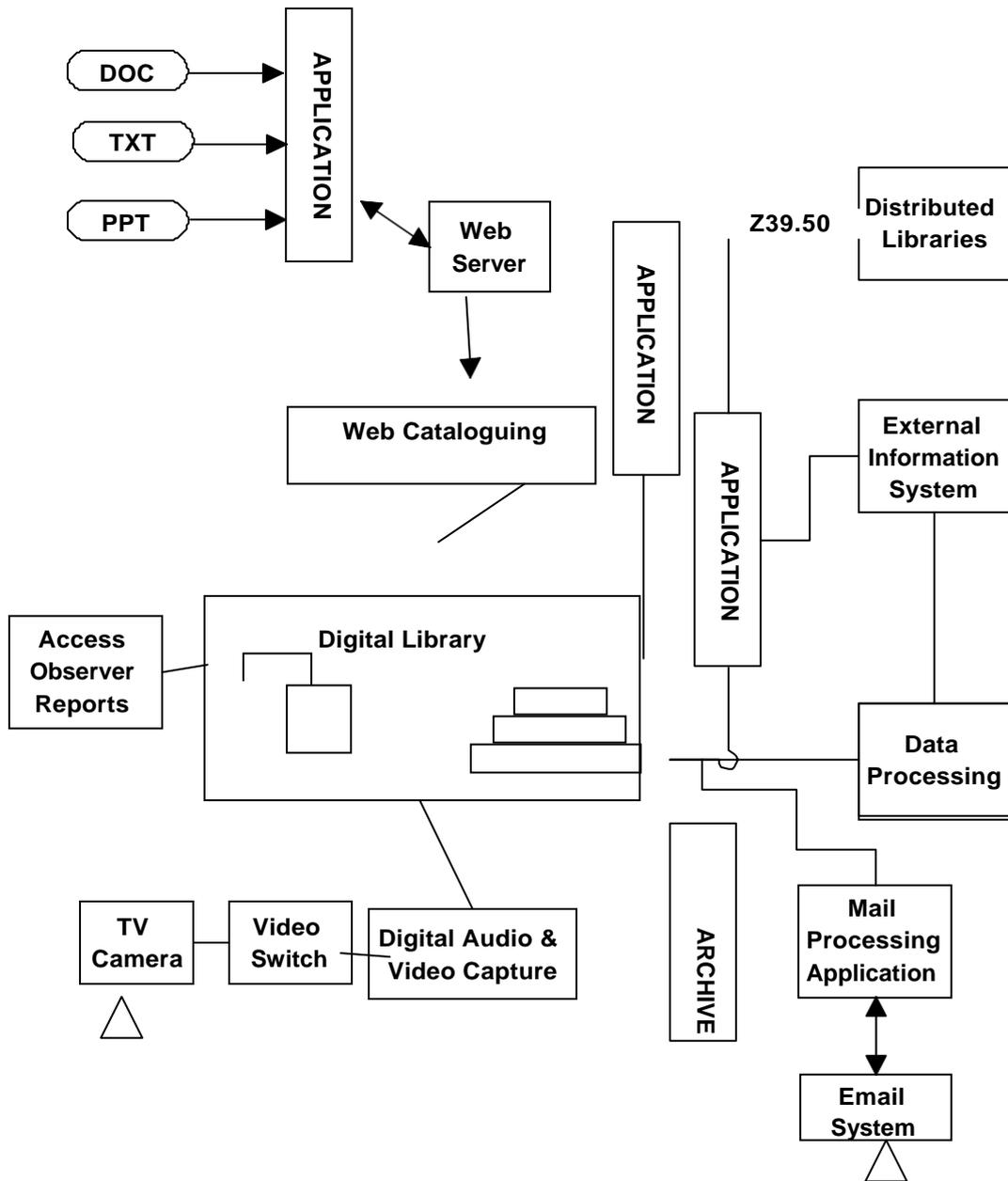


Figure 2.3: General Digital Library System Architecture [5]

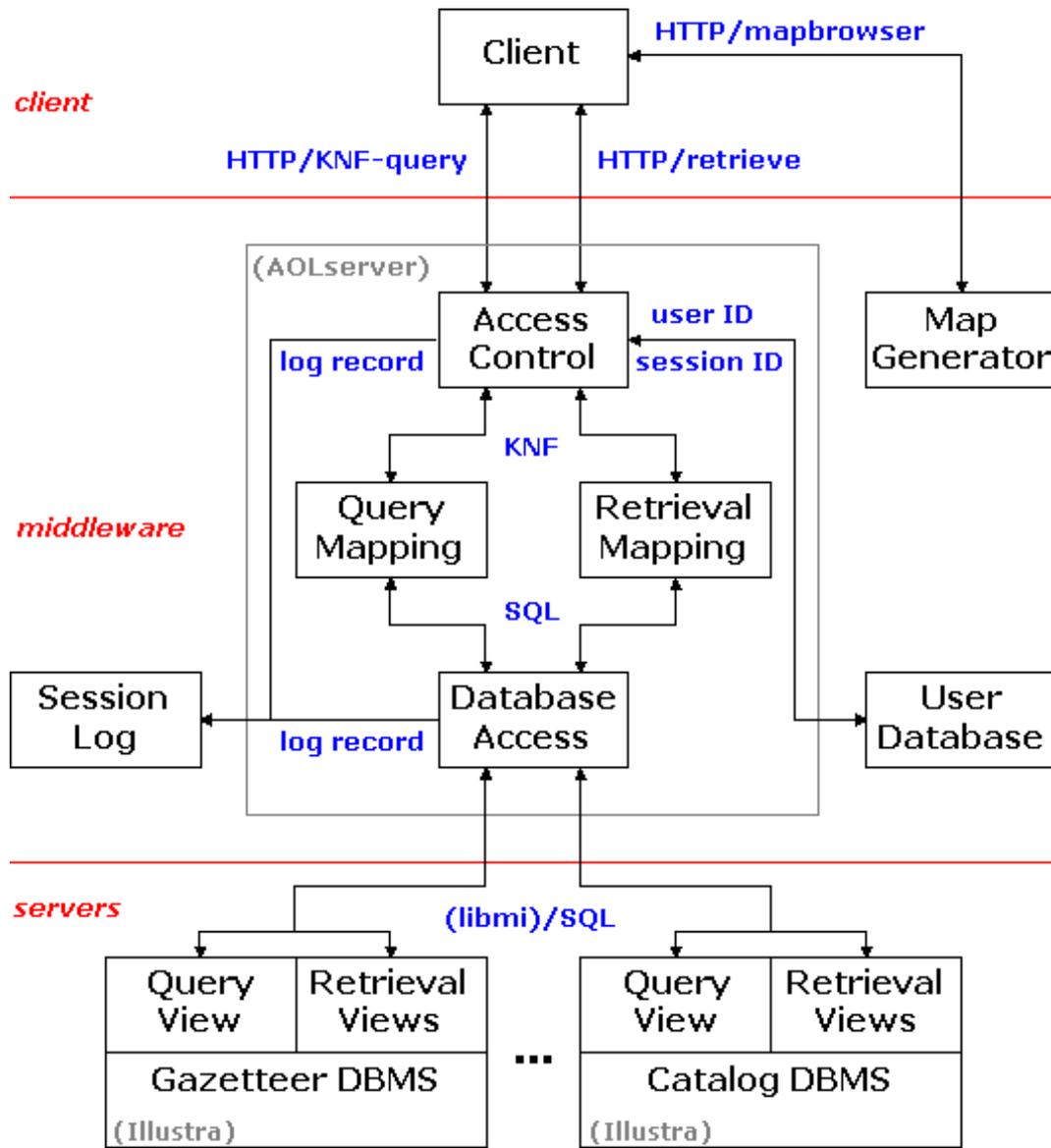


Figure 2.4: Architecture of Alexandria Digital Library [5]

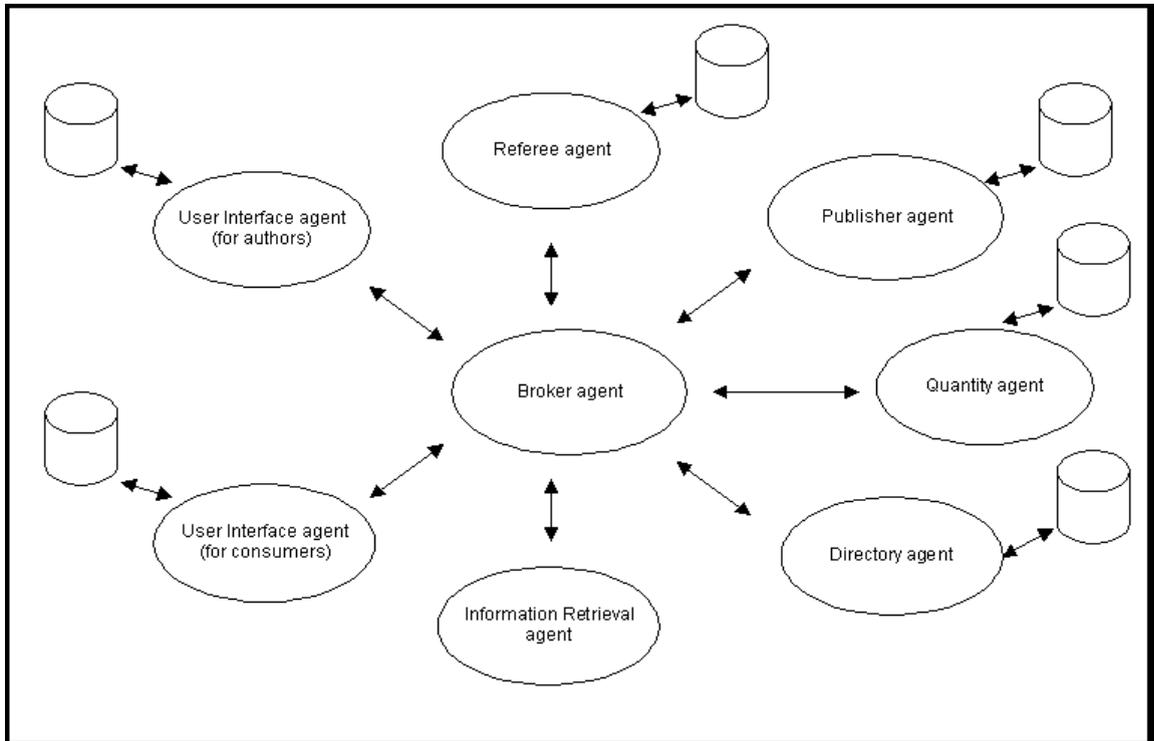


Figure 2.5: General Architecture of Virtual Digital Library [5]