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ICT in Libraries

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ICT in Libraries

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LIBRARY AUTOMATION

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UNIT 1 INTRODUCTION TO LIBRARY AUTOMATION

Structure

1.0 OBJECTIVES

After going through this Unit, you will be able to:

- understand conceptual views related to library automation and evolution of ILS;
- know features, advantages, requirements, steps, standards and models of library automation; and
- trace the path of progress and future directions in the development of ILS.

1.1 INTRODUCTION

Library services require a series of works like acquiring, preparing and organising documents of different types and available in many formats. The activities related to acquisition of documents, technical processing of acquired documents, circulation and maintenance of processed documents are known as housekeeping operations. In a traditional library system (managed manually) these time consuming, labour intensive activities and routine clerical chores are performed slowly and expensively by library staff. Libraries all over the world, right from 1970s (with the advent of Personal Computer) are increasingly attempting to automate some of these activities for minimising human clerical routines and thereby optimising productivity and creativity of library staff. Library automation is the generic term that denotes applications of Information Communications Technologies (ICT) for performing manual operations in libraries of any type or size. Library automation process can adopt three routes – i) a piecemeal approach, converting individual operations one at a time (for example installation of Cataloguing module alone to offer OPAC); ii) the process can work towards the integrated system progressively, using a 'planned installation' approach (for example installation of Member management module and Circulation modules after the Cataloguing module); and iii) it can go directly for a fully integrated system to cover operations of all subsystems in the library. Therefore, theoretically, a typical library automation may or may not be integrated and may or may not be applied on a Local Area Network (or Intranet). In such automation process, the functions that may be automated are any or all of the followings: acquisition, cataloging, member management, circulation, serials control, inter library lending, and access to online public access catalogue. But the radical development in hardware, software and connectivity along with the reduced costs paved the path for integrated library automation systems (ILS). Presently, library automation processes are integrated systems of a set of interlinked modules responsible for the management of different operational subsystems.

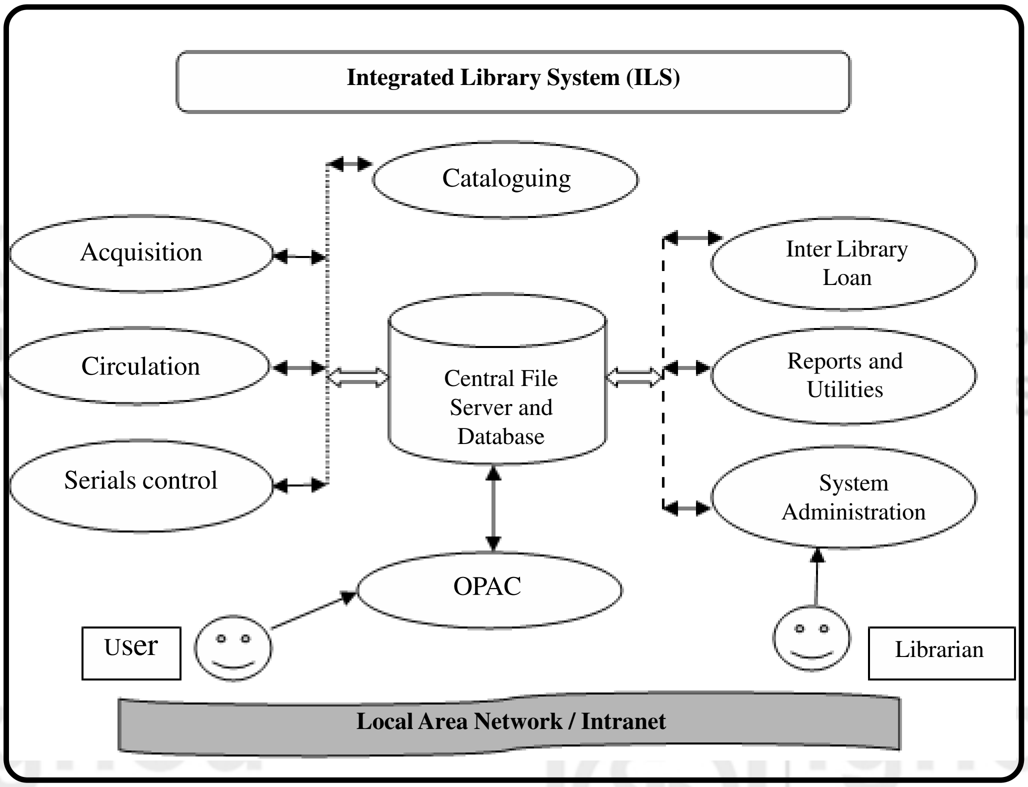

Fig. 1.1: Integrated Library System

Such integrated library automation is also known as Automated Library System. Library Management Software (LMS) forms the core of an automated library system. These LMSs are based on relational database architecture. In such systems files are interlinked so that deletion, addition and other changes in one file automatically activate changes in related files. It means integrated library management system is sharing a common database to perform all the basic functions of a library (see Fig. 1.1). For example, an integrated library system

(ILS) enables the library to link circulation activities with cataloging, serials control, report generation etc. at any given time. It makes use of a file server and clients in a local area network or wide area network (Fig. 1.1). Automated Library Systems now support three broad groups of library activities – i) housekeeping operations; ii) information retrieval; and iii) on-the-fly integration of library materials with open datasets . These are accessible through Local area Network (LAN) or Wide Area Network (WAN) and also over Internet. Modern library automation systems are Web compatible and accessible through Internet, Intranet and Extranet for information retrieval as well as data entry activities. Moreover, automated library systems are now capable to be integrated seamlessly with linked open data (like name authority data, subject access systems etc.), open contents (like book reviews, table-of-contents, cover images etc.) and social networking tools (like Facebook, Twitter etc.) through semantic web technologies and information mashup.

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

1) Define library automation. What are the needs of library automation?

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2) What do you mean by integrated library system? Enumerate the features of such systems.

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3) Distinguish between library automation and integrated library system.

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1.2 EVOLUTION OF LIBRARY AUTOMATION

Library automation has a fascinating history. You will be amazed to know that the whole automation process in our society began with a librarian – Dr. John Shaw Billing (Rayward, 2002). Herman Hollerith, the Census Bureau of USA employee, who invented punched card machinery, attributes the idea to a suggestion by Dr. Billing, the then librarian of Surgeon-General's Library (now the National Library of Medicine). Hollerith formed the Tabulating Machine Company in 1896, which later became the International Business Machines (IBM) Corporation, one of the largest organisations in computing industry (Mukhopadhyay, 2005). Library professionals initiated application of computers when existing library practices and procedures began to break down under huge bibliographical pressure (also known as information explosion) emerged during late 1950s and early 1960s. Development of low-cost personal computers in 1970s and improved connectivity of 1980s helped establishment of automated library systems mainly in developing blocks of the world. A decade wise analysis of developments in library automation (Mukhopadhyay, 2005) will help you in understanding the rapid upward changes in this domain.

- **Pre-computer era (1950s):** First there was the pre-computer era of unit record equipment.
- **Stand-alone era (1960s):** Then came the off-line computerisation in 1960s and early 1970s.
- **On-line system (1970s):** This was followed by the on-line systems of the 1970s.
- **Micro-computer era (1980s):** The 1980s saw the advent of microcomputers in the form of PCs, emergence of CDROM technology and Local Area Network (LAN).
- **Web era (1990s):** Internet revolution of 1990s paved the path of Web-enabled integrated library systems to support access and operations from anywhere at any time.
- **Open era (2000s):** Emergence of open library systems powered by open source software, open standards and on-the-fly integration with open data and open contents.

Although library automation began in 1930s (1936 to be exact) when punched card equipment was implemented for use in library circulation and acquisitions, the real library automation started in early 1970s with the use of low-cost PCs and locally developed software to automate library house-keeping operations. The whole phase of development i.e., 1970 to till date may be grouped into **five** distinct periods:

The First Automation Age: This era was characterised by computerisation of library operations by utilising either commercial automation package or software developed in-house. The development of shared copy–cataloguing system (also known as distributed cataloguing) was another significant achievement of this phase that utilised computer and communication technologies for collaboration and cooperation within the library community.

The Second Automation Age: This period of library automation was characterised by the rise of public access i.e., the arrival of OPAC as a replacement for the traditional card catalogue. This period also witnessed major developments in online access to abstracting and indexing databases, union catalogues, resource sharing networks and library consortia.

The Third Automation Age: This era was characterised by the full text access to electronic documents over high-speed communication channels. Digital media archiving was an important element of library automation in this period. The advent of Internet as global publishing platform and largest repository of information bearing objects revolutionised the ways and means of delivering library services. As a result, Web-centric library automation was norm of the time.

The Fourth Automation Age: It is also known as 'networked information revolution' era. This era supports a vast constellation of digital contents and services that are accessible through the network at anytime, from anyplace, can be used and reused, navigated, integrated and tailored to the needs and objectives of each user. Digital libraries, multimedia databases and virtual libraries are major achievements in this era. Most of the automated library systems in our country are in between the third age and fourth age of library automation.

The Fifth Automation Age: The next generation library automation uses interactive, collaborative and participative platform for developing user-oriented library services with the help of Web 2.0 tools and services. This era of library automation also characterised by the capabilities to on-the-fly integration of Linked Open Data (LOD) with local library resources and operations (for example - utilisation of global dataset VIAF (Virtual Internet Authority File) in managing name authority file of local library catalogue, and integration social networking tool such as Facebook with OPAC to post Like against a library document). Cloud based library management and Web-scale library management are norms of the fifth automation age.

Now you know the phases of development in library automation for almost the last forty-five years. However, a time line for the development of ground-breaking events in library automation can be a handy tool for you to grab the path of development.

1936-59 : Major events of this time period were as follows: Introduction of punched card for circulation control in library; Use of IBM 402, 403 and 407 for manipulating, analysis, sorting and retrieval of data; Vannevar Bush introduced the concept of 'Memex' in 1945.

1960-69 : Major breakthroughs of this period were as follows - Use of general-purpose computers that became widely available in the 1960s; H.P. Luhn, in 1961, used a computer to produce the "Keyword in Context" or KWIC index for articles appearing in Chemical Abstracts; Project "MEDLARS" started in 1961 that applied computer in measuring efficiencies of information retrieval systems; Computerised circulation system first appeared in 1962; Project 'Intrex' (aimed to provide a design for evolution of a large university library into a new information transfer system) started in 1965;

Project MARC, initiative by Library of Congress to provide a format for machine readable cataloguing data, started in 1965; Introduction of online interactive computer system in place of off-line batch processing systems began in mid 1960s; Initiation of projects like BALLOTS by Stanford University and MAC by M.I.T. These developments deal with the possibility of a new horizon for the library operations and services.

1970-79 : Important achievements of this time period – Minicomputers were introduced to automate circulation and books were bar-coded; Computer based acquisition systems were introduced to procure books and serials; ISBDs started appearing from 1971; OCLC established in 1971 to facilitate library cooperation and to reduce costs of processing works; ISO-2709 was developed in 1973 as the standard for data exchange format; OCLC started development of Worldcat in 1975 (Worldcat now contains 8 billion cataloguing records and considered as the largest bibliographic database in the world); Library networks started appearing all over the world.

1980-89 : Important events of the decade – Shared copy-cataloguing systems by using computer and communication technologies were established as a norm in 1980s; Remote access to on-line databases became a reality; Appearance of CDROM databases on indexing and abstracting journals started in early 1980s; Library automation packages initiated shifting towards relational architecture; Integrated automation packages began appearing in mid 1980s along with bar-coded circulation system; OPAC became very popular in this decade and made available on campus wide LAN for accessing;

1990-99 : Major events were as follows – Library automation packages started upgrading from client server architecture to web architecture; Large scale developments took place in the area of resource sharing, union catalogue and computerised inter library loan. Release of Z39.50 protocol in 1995 to share bibliographical information and to overcame the problems of database searching with many search languages; Formation of collective purchasing consortia started that can negotiate prices for all members of the consortium; Emergence of multimedia databases; Retrieval achieved maturity with an array of search operators; Emergence of Web-based library services; Release of Dublin Core Metadata Standard in 1995; Web-OPAC began appearing for almost all automated libraries; Conversion and digitisation of print contents into electronic format started in a big way; Full text access to information resources over Internet started against IP authentication; Integrated access interface emerged to act as one-stop access interface; IFLA introduced FRBR as a conceptual data model for bibliographical databases in 1998; Introduction and development of Eprint archives and digital libraries; MARC 21 family of standards (Bibliographic format, Authority format, Holdings format, Classification format and Community information format) released in 1999; RFID based inventory management and smart card based user access to on-line library services; OAI/PMH standard developed for metadata harvesting and initiatives started to make LMSs compatible with this standard;

2000-14 : Remarkable achievements of the present era are – Development of matured and globally competitive open source LMSs; Establishment of open standards like SRW, SRU, MARC-XML and development of standards for different sub-domains of library automation like NCIP (NISO Circulation Interchange Protocol); Applications of Web 2.0 tools and techniques in automated library system; Development of interactive OPAC to support user tagging, rating and comments; Improvements in searching and browsing with a set of newly developed search operators like Fuzzy search, weight-term search etc.; Application of semantic web technologies in LMSs to support integration of Linked Open Data (LOD) with library operations and services.

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

4) What are the five ages of library automation? Explain.

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5) Show a decade-wise growth of library automation technologies from 1970 to 2010.

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6) Enumerate the major technology breakthroughs in library automation since the introduction of PCs

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1.3 AUTOMATED LIBRARY SYSTEMS

The decade-wise development of library automation shows that the effects of ICT on libraries and information centers. The path of developments is characterised by three fundamental factors:

- **Mechanisation** – doing what we are already doing though more efficiently;
- **Innovation** – experimenting with new capabilities i.e., introduction of new services and improvement of existing services through the use of ICT; and
- **Transformation** – fundamentally altering the nature of the library operations and services through capabilities extended by ICT.

This section of the unit discusses how library automation – i) helps in mechanisation of library operations; ii) supports innovation in library operations and user-centric services; and iii) promotes transformation in organisation of information resources and dissemination of services. The discussion covers reasons for library automation, requirements for library automation, steps for developing an effective automated library system, model of library automation and how does an automated library system differs from a digital library system.

1.3.1 Rationale

Society is changing and so are the library users. There are many reasons of the ongoing changes but the most visible one is the impact of ICT on society. As a result libraries need to change to keep pace with these societal changes. It is also required for libraries to get continued support – political and financial from parent organisation as well as from government. However, the rationale for library automation may be summarised as below:

- Automation of library housekeeping operations is considered as an especially critical area from which future benefits will emerge. It means that if a library is not automated it cannot take advantages contributed by ICT such as digitisation, web-enabled library system, use of linked open data, remote management of library, interactive user services etc. ;
- Increased operational efficiencies are achieved through library automation;
- Automation of housekeeping operations relieves professional staff from routine clerical chores and thus make them available for end-users services;
- Betterment of library services in terms of speed, quality and efficiencies;
- Automation may create interactive, collaborative and participative platform for user-centric library services;
- Supports improvement of existing services and introduction of new services;
- Makes library free from two fundamental barriers of information access – time and space. A web-enabled library system allows access at anytime from anywhere and by anyone;
- Automated library system with the capability to generate extensive reports and statistics extends support as decision-making tool for library managers and policy makers;

- An automated library system is able to contribute to resource-sharing networks and on the other hand may take the benefits of resources and services of library networks; and
- Better management of staff, physical resources, financial resources and wider dissemination of information products and services.

But at the same time one should remember that library automation requires huge initial investments in developing network infrastructure, procuring hardware, buying/customising software, retraining of staff or in some cases recruitment of technical staff. It may lead to chaos in resource organisation and dislocations in user services during transformation phase. Initially users and staff may feel uncomfortable, but with the passing of time the benefits of library automation will be realised by all stakeholders. As ICT has spillover effect, an automated library system, after initial teething problem, soon begins to search other areas for extension of bibliographic services.

1.3.2 Prerequisites and Steps

After covering the previous sections, you now know that library automation is a challenging task. We need to know what are the requirements, what are the strength and weakness of the library to be automated, how to prepare the proposal and budget, how to select hardware and software, who requires to be trained, how to plan implementation of software, how to handle retro-conversion (RECON or retro-conversion is transferring old bibliographic resource into machine-readable forms in the software system) and finally how to manage the transformation process. The prerequisites of library automation may be studied under the following heads:

System-level requirements

The system level requirements include hardware, network and storage. These components build the necessary infrastructure for implementation of integrated library system. The infrastructural requirements for library automation may vary from simple (inexpensive) to very complex (expensive) depending on factors like functional requirements, software architecture, support for global domain-specific standards, interoperability requirements, number of library sites or branches, number of records to be managed, number of users to be supported, requirements for managing multi-lingual records, retrieval features, federated search capabilities etc. The infrastructural requirements is very high for an automated library system that aims to serve users through Web-OPAC (requires server, IP address and domain name), to support distributed cataloguing (to serve bibliographic data as Z39.50 server), and to take the advantages of cloud computing. Generally hardware level requirements include Server (a centralised mainframe or minicomputer architecture) and client PCs (low-end computers for data entry and end-user searching). Storage devices are required to store bibliographic data (full-text data in case of digital media archiving). Network is required to link server with storage devices and client PCs.

Software-level requirements

An integrated library system is managed by integrated library management software (LMS). LMS manages different functional modules (for different sub-systems of a library) on the basis of a common database (with different tables for different modules in relational model). Such a LMS supports seamless exchange of data (bibliographic data, financial data, member data etc.) between the different subsystems of an integrated library system. The essential features that should be supported by an ILS (or LMS) must be known before selection of software. These are applicable to all modules of any modern LMS and should include but not limited to the following features:

- The LMS must be fully integrated, using a single, common database for all operations and a common operator interface across all modules;
- The LMS should have capability of supporting multiple branches or independent libraries, with one central computer configuration sharing a common database;
- The LMS must allow unlimited number of records, users and organisation-specific parameters (e.g. loan period rules, fine calculation criteria, hold parameters etc.);
- The package should include following fully developed and operational facilities at multiple customer sites:
  - Bibliographic and inventory control
  - Authority control
  - Public access catalogue
  - Web catalogue interface
  - Information gateway (telnet, www, Z39.50, proxy server)
  - Acquisition management
  - Serials control
  - Electronic data interchange (EDI)
  - Reservation and materials booking
  - Circulation control
  - Customised generation of reports and usage statistics
  - One step administrative parameters setting
  - Z39.50 sever (minimum version 3 and bath profile level complaint) and Z39.50 client
  - Z39.50 copy cataloguing client
  - Marc 21 bibliographic and authority record import/export utility
  - Outreach services
  - Digital media archive system and Multimedia
  - Fund accounting , Bills and fines
  - Inter library loan
  - Interoperability and crosswalk
  - Web 2.0 supports
- LMS must provide continuous backup in suitable media (as per the choice of libraries) so that all transactions can be recovered to the point of failure;
- LMS must be compliant with the following standards (see section 1.4.1 for a list of standards):
  - Z39.50 information interchange format
  - MARC 21, UNCODE (UTF-8 OR UTF-16)
  - Z39.71 holdings statements
  - Z39.50 information retrieval service (client and server version3)
  - EDIFACT (EDI standard)
  - IEEE 802.2 and 802.3 Ethernet
  - HTTP, TCP/IP, Telnet, FTP, SMTP

- The LMS should be based on web-centric architecture and extend support for a range of multi-user and multitasking operating systems and RDBMSs;
- The LMS must be compliant with UNICODE standard for multilingual support and RFID for inventory management and self-issue/return facility;
- Vendor/Developing group should provide training to enable library staff to become familiar with system functions and operation, should supply full and current system documentation in hard copy and in machine-readable form suitable for online distribution and the LMS should include extensive online help for users and staff;
- LMS must support multiple hardware architecture in terms of server, network infrastructure, PC-workstations and peripheral devices;
- LMS must be supported with regular maintenance and on-call service, periodical software upgrades, continuous R & D, trouble-shooting of third-party software such as database package and the library automation package, distribution of problem fixes/patches and emergency services for system failures and disaster recoveries;
- The package must provide security to prevent accidental or unauthorised modification of records through the establishment of access privileges unique to each user on the system and restriction of specific functions to specific users;
- LMS should provide graphical user interface including, but not limited to extensive online help, user self-service and personalisation features. The system should be supported with PC-based alternative that will allow circulation to continue in the event of system failure, communication failure and downtime required for maintenance;
- LMS must be compliant with web 2.0 features to support interactive, collaborative and participative platform; and
- LMS should be updated regularly to take advantages of cutting-edge technologies like cloud computing, linked open data and semantic web.

Steps of library automation

Library automation is a complex process and should be planned astutely. The complete process of library automation may be divided into following steps:

- Software selection
- Hardware selection
- Site preparation
- General training
- Customisation
- Defining procedures for
  - o Bibliographical data entry
  - o Administrative data entry
  - o Financial data entry
- Commissioning

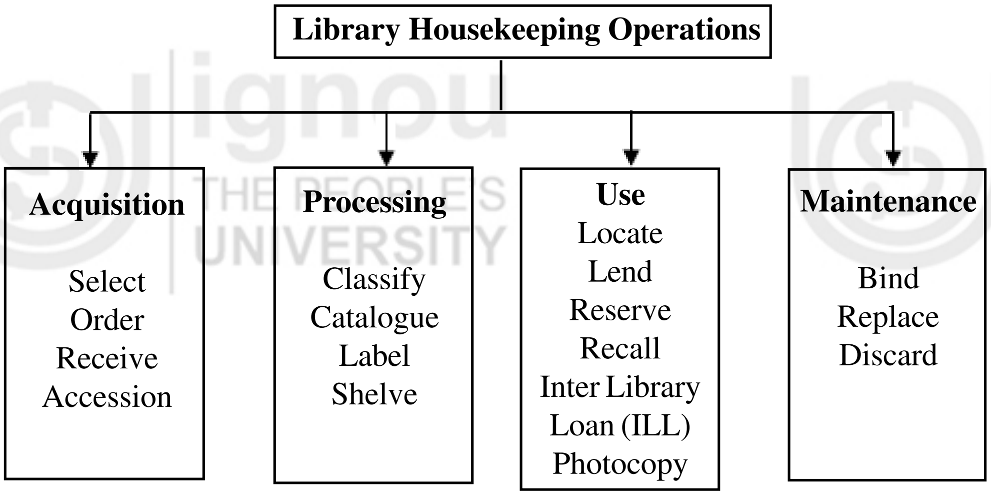
It is quite obvious that implementation of the above steps in library automation requires background study or analysis of the library system (see section 1.3.3 for system analysis process). It is a precondition to utilise library automation package for effective results. A library will not be able to take full advantages of automation until and unless it's manual functions are perfect and justified. Therefore, the procedures and tasks followed in different sections should be analysed in terms of :

- Special features of the library system
- Local variations (their validity and usefulness)
- Limitations of the existing system
- Nature and objectives of library
- Total number of collection and nature of collection
- Per year acquisition and procedures followed for acquisition
- Per year subscription of serials and number of back-volumes
- Number of users and their categories
- Per day transactions (issue/return/reservation)
- Availability of multilingual documents
- Need of information services (CAS/SDI etc.)
- Future plan (in terms of networking and consortia, digitisation, cloud computing)
- Available manpower (computer literate staff, retraining of staff, recruitment of technical staff).

This is an illustrative list of factors to be considered during the process of library automation. In reality a library needs to prepare a comprehensive of list of such factors for effective utilisation of the automated library system.

1.3.3 Procedural Model

Library automation aims to support workflows of a library in an integrated setup. It means different subsystems of a library (like acquisition, cataloguing, circulation, serials control, OPAC etc.) need to be supported by an ILS. Therefore, to understand library automation we need to understand first the library workflows. In fact an ILS (or LMS) automates the workflows of a library system. Most of the LMSs are based on a model called **procedural model of library automation** (first proposed by P.A. Thomas in an analytical study of library automation conducted by the then ASLIB). The model proposes that a library system has mainly two subsystems – administrative subsystem and operational subsystem. We cannot automate the process of administration but if we can automate operational subsystem, it may help administrative subsystem in taking right decision at the right time. In fact automation of operational subsystem may provide a wholesome MIS (Management Information System) to library managers. Operational subsystem comprises mainly four subsystems for performing housekeeping jobs through eighteen procedures. These procedures under each and every operational subsystem require one or more of six possible activities. There are fifteen basic tasks for performing procedures and activities. In short, procedural model of library automation proposes two basic subsystems, four operational subsystems, three levels, eighteen procedures, six activities and fifteen basic tasks as library workflow irrespective of the type and size of libraries and it advocates automation of the procedures, activities and tasks through different modules of an ILS.



The functions and activities of one division is entirely different from other divisions but they are closely related and the combined efforts lead towards the better library services. It is quite clear now that libraries are complex systems that include subsystems and components. The main two subsystems are operational subsystem and administrative subsystem. Library housekeeping operations are part of the operational subsystem. As per the analytical study of ASLIB (Association of Information Managers, UK), the operational subsystem may be divided into four further subdivisions namely Acquisition, Processing, Use and Maintenance. Within each of these divisions there are a number of procedures and within each procedure there is one or more of six possible activities. The tabular presentation of the place and scope of housekeeping operations related to different subsystems in a library system (as per the procedural model) is given below:

Table 1.1: Procedural model of library automation (Source: Mukhopadhyay, 2005)

System	Subsystems	Operational Subsystems	Procedures	Activities (Common to all Procedures)
Library System	**Operational Subsystem**	**Acquisition**	Select Order Receive Accession	***Initiate*** (To commence a procedure) ***Authorise*** (To approve a procedure) ***Activate*** (To implement a procedure through appropriate action) ***Record*** (To record what action has been taken) ***Report*** (To notify staff or user about the action taken) ***Cancel*** (To stop a procedure or undoing an action)
		Processing	Classify Catalogue Label Shelve	
		Use	Locate List Lend/Issue Reserve Recall/Return ILL (Inter Library Loan) Photocopy	
		Maintenance	Bind Replace Discard	
	Administrative Subsystem			

In considering libraries from one general organisational point of view, the analysis of housekeeping system is useful for automation of a library. It is a prerequisite to design and use library management software and to communicate with software vendors and programmers. A close analysis of the operations involved in library housekeeping provides us three hierarchical levels – **procedures, activities and tasks**.

Procedures and Activities

The eighteen procedures listed in the previous paragraph are common to libraries of different types. The design and use of an automated library housekeeping system requires the analysis of all these procedures into their atomic structure. It will help to understand and implement mechanised housekeeping operations in an automated environment. The procedures under each and every operational subsystem have been analysed by P.A. Thomas in terms of six possible activities – *initiate, authorise, activate, record, report and cancel*. All of these activities may not be involved in every procedure. There are one or more six possible activities against each procedure. The six common activities are defined as:

- **Initiate** – That which makes it apparent that a procedure should be commenced.
- **Authorise** – In some cases, the decision to carry out a certain procedure must be approved before any further action is taken.
- **Activate –** When a procedure is known to be necessary and in some cases approved, it is usually implemented by taking appropriate actions.
- **Record –** The function that states or records what action has been taken.
- **Repor**t – To notify library staff or user that an action has been taken.
- **Cancel** – To stop a procedure, in particular the aspect of revoking or undoing an action.

Tasks

The third level in the hierarchy is concerned with 'tasks' within an activity under each procedure. Task means a related group of operations carried out to perform a particular kind of job. In an automated library system a task is the collective functions of the elements for the accomplishment of the module at the next higher level. Tasks within each activity, just as the activities themselves, may not all be necessary to each procedure. Most of the works in the operational subsystems of a library include making or using discrete records with bibliographic and administrative information referring to one particular document. In this context, ASLIB defined a set of fifteen tasks for the basic procedures. These are – *pass, receive, discard, place, remove, search, duplicate, attach, separate, move, sort*. Such tasks are supported by other four element tasks namely *read, verify, enter and decide*.

1.3.4 Traditional, Automated and Digital: Three Eras of Library Systems

The application of ICT tools in the form of hardware, software and network changed conventional library system considerably right from 1970s. Now, we have an array of modern information handling systems named as computerised library system, automated library system, electronic library system, digital library system and virtual library system. However, we are going to restrict discussion to two stable modern library systems – automated library system and digital library system. You already know what an automated library system is. Now question comes what is a digital library system and how does it differ from automated library system? Digital libraries are major application entities of Internet and Web technologies. These are considered as next generation library services. In simple words, Digital libraries are managed collections of digital objects. These entities enable the creation, organisation, maintenance, management, access to, sharing and preservation of digital knowledge bearing objects or document collections. Digital libraries are being created today by many institutes and agencies for different target groups and in diverse fields like agriculture, cultural heritage, education, health, governance, science, social sciences, social development, etc. In its final shape a digital library system will be a single-window federated search interface for a diverse range of information resources collected or optimised by a library system.

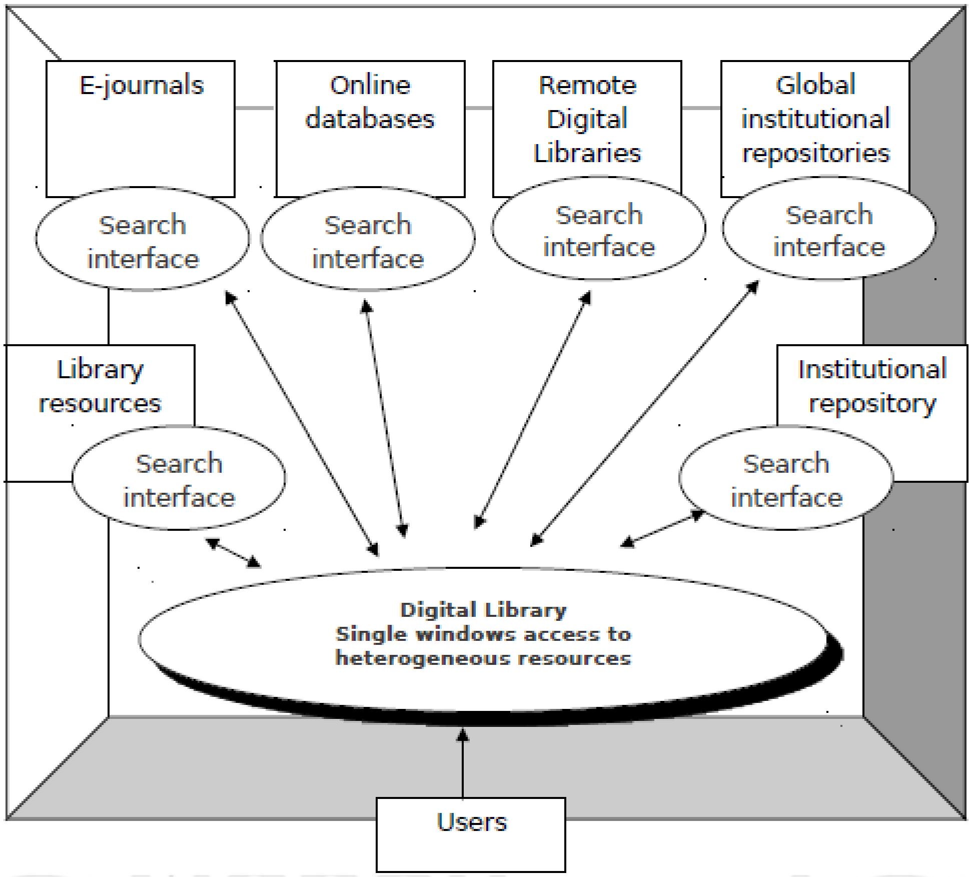


Fig. 1.2: Digital library system

Availability of free/libre open source software (FLOSS) based digital library software packages, application of open standards and sharing of domain knowledge through Wiki, Blogs etc. help in designing Digital libraries even in developing block of the world. Now the question comes that what are the advantages of digital libraries? There are some obvious benefits of Digital libraries over the automated library systems. Some of the key benefits of digital libraries are:

- Traditional libraries are associated with the organisation and provision of access to physical material like print-on-paper publications.

- Automated library systems are providing improved access to their collections but online access facilities are limited to the computerised library catalogue (OPAC).
- Digital libraries differ significantly from such libraries because these entities facilitate online access to and work with digital versions of full text resources in multimedia-driven environment.

Library automation activities address two major issues – library housekeeping operations and access to library resources. An automated library system has cataloguing data in digital format but source documents are mostly available in print formats. In a digital library setup both metadata (document description data) and documents are available in digital format. The other major differences are:

Table 2: Automated Vs. Digital library systems

Automated library system	**Digital library system**
Only metadata (cataloguing data) is finely searchable	Both metadata set and full-text resources are finely searchable
Provides document description data set, not documents.	Provides document description data set and source documents
Based on Z39.50 standard for cross-system catalogue search/retrieve	Based on OAI/PMH protocol for metadata harvesting
Supports standard bibliographic formats (MARC 21, CCF) for document description	Supports generic and domain-specific metadata schemas (e.g. Dublin Core, LOM, GILS etc.) for resource description
Processes global resources for local users	Processes global and local resources for local and global users
Generally follows centralised processing – distributed access architecture	Generally follows distributed processing – distributed access architecture

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

7) What is the rationale for integrated library system?

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8) Discuss the software-level prerequisites for an integrated library system.

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9) What is Procedural model of library automation? Illustrate.

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10) What is a digital library system? How does it differ from automated library system?

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1.4 AUTOMATED LIBRARY SYSTEM: STANDARDS AND SOFTWARE

Integrated library systems depend on two core components – standards and software architecture. Libraries are now operating in a distributed networked environment, where standards are essential for efficiency and interoperability. Order, collaboration and interoperability are three most important prerequisites for effective application of ICT in library operations and services. Library automation is no exception. Therefore, we need to know about standards for developing automated library systems and LMSs should follow strictly different global and national standards prescribed for the domain of library automation.

1.4.1 Standards

Standards are developed by general agreement among stakeholders of an area of human activity. These are used by professional like scientists, engineers, technologists etc. for their respective domain of activities. We often use the terms *standards, guidelines and specifications* synonymously. A “guideline” is a statement of policy by a person or group having authority over an activity. A “standard” is formulated by agreement and applicable to an array of levels – corporate, national, or international. A “specification” is a concise statement of the requirement for a material, process, method, procedure or service. Standards are frequently updated, modified or revised to keep pace with the technological changes and practical requirements (Withers, 1970). ANSI (American National Standards Institute) defined a standard as a specification accepted by recognised authority as the most practical and appropriate current solution of a recurring problem. IEC Guide 2:2004 of ISO (International Standards Organisation) defines a standard as a document, established by consensus and approved by a recognised body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context. Standards perform important roles in the development of integrated library systems in view of the followings:

- to act as the pattern of an ideal;
- to set a model procedure;
- to achieve interoperability in heterogeneous environment;
- to establish measure for appraisal;
- to act as stimulus for future development and importance; and
- to help as an instrument to assist decision and action.

Standards are mainly developed by Standards Development Organisations (SDOs). An SDO is any entity whose primary activities are developing, coordinating, promulgating, revising, amending, reissuing, interpreting, or otherwise maintaining standards. SDOs are generally grouped by two parameters – geographic designation (e.g. international, regional, national) and organisational authority (e.g. governmental, quasi-governmental or non-governmental entities). Library professionals are generally interested in the library standards developed by their national standard organisations (e.g. BIS – Bureau of Indian Standards in India) and library standards developed by ISO (International Standards Organisations), NISO (National Information Standards Organisation, US) and BSI (British Standards Institute, UK). The library standards developed by NISO are American national standards but in many cases these standards are used by libraries/related organisations across the globe (e.g. Z39.50). These SDOs develop standards in the domain of library services through designated committees and sub-committees. The committee IDT/2 is entrusted by BSI (http://www.bsi-global.com/) for Information and Documentation. There are mainly three American National Standards Committees under NISO that develop standards affecting libraries, information services and publishing (www.niso.org). These are X3 (Information Processing Systems); PH5 (Micrographic Reproduction); Z85 (Standardisation of Library Supplies and Equipment); and Z39 (Library and Information Sciences and Related Publishing Practices). Of these, Z39 has developed more standards directly related to LIS fields than others. TC 46 committee of ISO (www.iso.org/iso/) is responsible for standardisation of practices relating to libraries, documentation and information centres, publishing, archives, records management, museum documentation, indexing and abstracting services, and information science. The secretariat of TC 46 is in France (AFNOR - Association française de normalisation). It works through three working groups (WG), four sub committees (SC) and one coordinating group (CG). In BIS, India, MSD 5 (www.bis.org.in) is the Sectional Committee for Documentation and Information.

Although it is difficult to list all the standards related to automated library systems, we may go for listing a set of minimum standards that need to be supported by an ILS/LMS to remain globally competitive and interoperable. These are:

- ISO – 2709 for bibliographic data interoperability;
- Standard bibliographic formats compliant with ISO - 2709 (e.g. MARC 21, UNIMARC, CCF/B);
- Z39.50 protocol standard for distributed cataloguing;
- Z39.71 standard for holdings statements;
- BS ISO 9735-9:2002 Electronic data interchange for administration, commerce and transport (EDIFACT);
- Z39.83-1 (NISO Circulation Interchange Part 1: Protocol (NCIP));
- Z39.83-2 (NISO Circulation Interchange Part 2: Protocol (NCIP));
- ISO/CD 28560-1(Information and documentation — Data model for use of radio frequency; identifier (RFID) in libraries — Part 1: General requirements and data elements);
- ISO/CD 28560-2 (Information and documentation — Data model for use of radio frequency; identifier (RFID) in libraries — Part 2: Encoding based on ISO/IEC 15962); and
- ISO/CD 28560-3 (Information and documentation — Data model for use of radio frequency identifier (RFID) in libraries — Part 3: Fixed length encoding); and
- ISO/IEC 10646: 2003 (Universal Multiple-Octet Character Set or UCS).

Apart from these formal standards (de jury standards), there are a few specifications (may be considered as de facto standards) in the domain of library services, which are widely in use across different library systems in different countries. Most of these internationally agreed upon informal standards are developed by national libraries (e.g. Library of Congress) and library associations (e.g. ALA, IFLA etc.). Some of these very important non-formal standards are –

- MARCXML – MARC 21 data in an XML structure (developed by Library of Congress - http://www.loc.gov/standards/marcxml/) acting as base standard for bibliographic data export/import in place of ISO-2709;
- MODS (Metadata Object Description Standard) – XML markup for selected metadata from existing MARC 21 records as well as original resource description (developed by Library of Congress – http://www.loc.gov/standards/mods/);
- MADS (Metadata Authority Description Standard) – XML markup for selected authority data from MARC21 records as well as original authority data (developed by Library of Congress – http://www.loc.gov/standards/mads/);
- METS (Metadata Encoding & Transmission Standard) – Structure for encoding descriptive, administrative, and structural metadata (developed by Library of Congress -http://www.loc.gov/mets/);

- PREMIS (Preservation Metadata) – A data dictionary and supporting XML schemas for core preservation metadata needed to support the long-term preservation of digital materials. (developed by Library of Congress – http://www.loc.gov/standards/premis);
- SRU/SRW (Search and Retrieve URL/Web Service) – Web services for search and retrieval based on Z39.50 (developed by Library of Congress - semantics http://www.loc.gov/standards/sru/); and
- OAI/PMH Version 2.0 – Open Archive Initiative/Protocol for Metadata Harvesting (developed by Open Archive Initiative).

1.4.2 Software

You already know that library management software forms the core part of integrated library automation. You also know what are the prerequisites for an ILS, what are the standards that need to be supported by ILS, and how procedural model of library automation is guiding development of ILS all over the world. The rapid development in utility of hardware, software and connectivity along with the reduced costs paved the path for integrated library automation systems. Current library automation software also known as Library Management Software (LMSs) are integrated systems of a set of related modules responsible for the management of different operational subsystems. These LMSs are based on relational database architecture. Most of the LMSs are presently based on procedural model of library automation and follow a modular approach to perform the tasks related to housekeeping operations. Generally, the whole package is divided in **modules** for each operational subsystem. Modules are divided into **sub modules** and each sub module supports various **facilities** to carry out tasks related to the procedures.

Library Automation Package	→ **Modules**	→ **Sub-Modules**	→ **Facilities**

For example, the SOUL package library automation software developed by INFLIBNET, Ahmadabad) includes six modules of which four are for operational subsystems. The other two, namely administration and OPAC are meant for setting up various administrative parameters and searching and retrieving the library resources respectively. Another example may be cited from KOHA – an open source library management software, developed by Horowhenua Library Trust (Katipo team), Newzealand and running at libraries all over the world. It includes one common module for acquisition and cataloguing and other five modules are related with circulation, OPAC, administration etc. A typical LMS supports selection, ordering, acquisition, processing, circulation, serials control, dissemination of information services and also extend help in library administration, planning & decision making process as a management tool. The individual tasks carried out by an ILS under each prime functional subsystems may be identified as below (see Unit 2 in this block for a detail discussion on housekeeping activities):

Ordering and Acquisition

- Ordering
- Receipting

- Claiming
- Vendor database management
- Budgeting and Fund accounting
- Currency conversion
- Suggestions (from users) management
- Enquiries (order status, receiving status)
- Accessioning (in MARC 21 format)
- Bill processing
- Payment
- Reports and Statistics.

Cataloguing

- Standard formats support
- Authority control (in MARC 21 authority format)
- Integration with Linked Open Data (LOD)
- Unicode-compliant multilingual data processing
- Retrieval with sophisticated search operators
- Integration with virtual keyboard for multilingual searching
- Shared cataloguing
- Z39.50 based copy cataloguing
- Output generation and holdings information
- User services (interactive and participative).

Access Services

- Online access
- Public access interface (OPAC)
- Web access and Remote access
- Social-network enabled OPAC
- Gateway services.

Circulation Control

- Setting of user privileges
- Circulation rules
- Issue, return and renewal
- Reservation (user-driven)
- Fine calculation
- User management
- Reminders and recalls
- Enquiries (about item, borrower, reservation)
- Reminders and notices
- Reports and statistics and patron self services.

Serials Control

- Order placement and renewal of subscriptions
- Kardex management
- Receiving and claiming
- Binding control
- Fund accounting
- Cataloguing of serials
- Enquiries (arrival of serials issues)
- Reports and statistics.

MIS

- Reports and statistics
- Analysis of statistics
- Usage statistics (compliant with COUNTER).

Inter Library Loan (ILL)

- ILL protocol
- ILL management.

Outreach Services

- Community information services
- Social-networking support
- Library blog
- Online help for users.

Digital Media Archiving

1) Full-text search
2) Support for media formats
3) Federated search facilities.

System Administration

- Privileges control
- Branch management
- Backup and restoration
- System configuration.

A library may procure commercially available ILS or may opt for implementing an open source ILS. But the above-mentioned basic tasks of an ILS are common to all types of ILSs or LMSs.

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

11) What is a standard? Why an ILS should support global standards? List the standards required for a globally competitive ILS.

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12) Discuss the typical tasks performed by an integrated library system.

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1.5 AUTOMATED LIBRARY SYSTEM: GLOBAL RECOMMENDATIONS

Libraries of developed countries started taking benefits of ICT through library automation during mid-seventies. Libraries in developing block of the world realised advantages of library automation in early eighties and the process is still going on. But the socio-economic and socio-technical environments within which these libraries operate are changing more rapidly than libraries (in developing block of the world) are changing to meet it. However, in general we can say that present library systems are outgrowing their traditional organisation and discovery tools. Almost all the basic library activities and services are now maintained in an Integrated Library System (ILS) that manages acquisitions, cataloging, circulation, reporting, resource discovery and automatic alerting services. With the advent of socio-technical changes all over the world users expectations have expanded to demand more services in an interactive, quicker and easy way. In many cases, such demands go beyond the scope of a typical ILS. Users now want to find, locate, navigate and obtain resources available in his/her library, at nearby institutions and from open access public domain through a single-window search interface seamlessly. They also want full-text search facility from a single-window federated search interface and when they do find something of interest, they expect to use the library's services for obtaining resources from wherever possible. This situation calls for a set of global recommendations in developing new generation ILS. Such global standards are also required to act as pathfinders for library professionals as well for ILS developers. There are three such sources that can guide us in shaping integrated library systems in view of the future requirements – 1) Open Library Environment (OLE) project recommendations;

2) Digital Library Federation (DLF) - ILS Task Group (ILS-DI) recommendations; and 3) study of Request for Proposals developed by different libraries.

1.5.1 OLE Recommendations

Open Library Environment project (OLE project - http://oleproject.org) or the OLE project, funded by Andrew W. Mellon Foundation and participated by more than 300 libraries, started with following objectives – i) to analyse library business processes; ii) to define a next-generation library technology platform; iii) to design Service Oriented Architecture (SOA) for library software; and iv) to frame a community-source model of development and governance. The principal aim of OLE project is cost-effective integration of library management with other institutional systems. The OLE project published the Enterprise Resource Planning (ERP) based Abstract Reference Model (http://oleproject.org/overview/ole-reference-model) in 2009. This model shows the relationship between OLE middleware, OLE components, entities, and third-party components, such as Identity Management, Institutional Repositories, and Course Management Systems. As a whole, the OLE framework for future library system is characterised by – 1) Flexibility (Supports for wide range of resources; accessed by a wide range of customers in a variety of contexts); 2) Community ownership (Advocates systems that are designed, built, owned, and governed by and for the library community on an open source licensing basis); 3) Service Orientation (Prescribes technology-neutral service-oriented framework that ensures the interoperability of library systems); 4) Enterprise-Level Integration (Facilitates integration with other enterprise systems such as research support, student information, human resources, identity management, fiscal control, and repository and content management); 5) Efficiency (Provides a modular application infrastructure that integrates with new and existing academic and research technologies); and 6) Sustainability (Creates a reliable and robust framework to identify, document, innovate, develop, maintain, and review the software necessary to further the operation and mission of libraries). See Unit 3 in this Block for a summary of OLE recommendations. The Open Library Environment Project Final Report is available at http://oleproject.org/final-ole-project-report/.

1.5.2 ILS-DI Recommendations

In regards to the integrated systems of libraries (automation and digitisation), DLF ILS Discovery Internet Task Group (ILS-DI) Technical Recommendation is playing a pivotal role. These recommendations are framed in view of the variations in user demands and developments in ICT. As per these recommendations library software systems should – i) improve discovery and use of library resources; ii) support a clear set of expectations (framed systematically) for users (end users and power users) and developers; iii) be open and extensible for recommendations applicable to existing and future system requirements; iv) support interoperability, inter-operation and cooperation; and vi) be responsive to the user and developer community. ILS-DI recommendations can be logically related with a set of twenty-five interlinked functions. Each of the twenty-five (25) functions can be grouped into one of four overall categories: 1) Data aggregation (harvesting and distributed searching); 2) Search (simple and advance search operators); 3) Patron services (general and interactive interfaces); and 4) Integrated service framework (on-the-fly integration of open contents, data sets etc.). A summary of ISL-DI recommendations is provided in

Unit 3 of this block. For DLF ILS Discovery Internet Task Group (ILS-DI) Technical Recommendations visit www.diglib.org/architectures/ilsdi/DLF_ILS_ Discovery_1.0.pdf and for DLF ILS Discovery Internet Task Group (ILS-DI) Technical Recommendations see www.diglib.org/architectures/ilsdi/DLF_ILS_ Discovery_ 1.1.pdf.

1.5.3 Request for Proposals (RFPs)

RFPs, developed by different libraries, library associations and ILS experts, are good source of information to trace the recent developments in automated library systems. Study of RFPs helps us to determine requirements, prescribing standards and demanding services from ILS vendors and developers. It acts as a guiding document for ILS developers and library automation managers. A request for proposal (RFP) is a formal request for a bid from suppliers of library systems. The RFP provides the ILS vendor with the outline, purpose, scope, description, minimum service requirements, minimum standards requirements, administration and security issues etc. for the automated library system in a comprehensive manner. The RFP process is useful in identifying the needs and priorities of the library including the future plans related with library automation. The RFP prescribes the resources that need to be acquired, the services that need to be offered, the standards that need to supported, the selection criteria for ILS, and the requirements for the software vendor. It also sets the timeframe for the project of automating a library. A RFP for library automation is a critical document in the process of implementing an ILS. L. T. David (2001) advocated consulting following online resources for developing RFP on ILS:

- Cohn, John M. and Kelsey, Ann L. Planning for automation and use of new technology in libraries. Online. URL: http://web.simmons.edu/~chen/nit/NIT'96/96-065-Cohn.html
- Integrated Library System Reports. Sample Request for Proposals (RFPs) and Request for Information (RFIs) for library automation projects. Online. URL: http://www.ilsr.com/sample.htm
- Kirby, Chris. and Wagner, Anita. The Ideal Procurement Process: The Vendor's Perspective. Online. URL: http://www.ilsr.com/vendor.htm
- Planning and Evaluating Library Automation Systems. Online. URL: http://dlis.dos.state.fl.us/bld/Library_Tech/Autoplan.htm
- Sample RFP. Library HQ. Online. URL: http://www.libraryhq.com/rfp.doc.

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

13) Discuss how ILS-DI and OLE recommendations may help in shaping futuristic ILSs.

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14) What is a RFP? How RFPs may help us in library automation?

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1.6 AUTOMATED LIBRARY SYSTEM: DEVELOPMENT OF RFP

You already know what RFP is and how these documents may help us in planning and implementing integrated library system for developing automated library system. It's already clear to you that the first logical step in library automation is to develop RFP. The RFP acts as a base document in developing automated library system, just as a blueprint helps in developing a building. A comprehensive RFP aims to achieve two broad groups of tasks – 1) guides the library in evaluation of integrated library systems; and 2) helps the library to choose and acquire the most appropriate system. Although not all libraries in India (also in abroad) that purchase ILS prepare RFPs, the process of preparing an RFP helps the library identify its needs, priorities, options and also in setting future course-of-action for ICT-enabled library services. Moreover, it may guide a library in customising open source ILS according to goals and requirements set in RFP, if the library decided to use open source software.

Needs for developing RFP

You already know that the widespread use of Integrated Library Systems (ILS), global communications via the Internet, increasing numbers of digital library initiatives, availability of web 2.0 tools, rising of cloud computing, evolving of linked open data have made the need for compliance with standards for a library system more crucial than ever. But which standards are important when considering a library system, what services are necessary for next generation library users, what software architecture is suitable for rapidly changing computing environment, what data formats are the most comprehensive? And how can one determine if a commercially available ILS or an open source ILS really complies with global standards related to functional subsystems of a library? Here lies the importance of developing RFP for library automation. The RFP aims to answer these questions through:

- Setting criteria for evaluating RFP responses and ILS products;
- Prescribing standards compliance needs;
- Identifying the current national, regional and international standards including de facto standards;
- Conforming requirements specific to the library system;
- Assisting in effective and clear communication between library managers and ILS developers; and
- Guiding application of relevant standards for major functional areas of library automation, e.g. Bibliographic Format, Record Structure, Information Retrieval, Serials, etc.

Components of RFP

The RFP requires being a structured document. The components of a typical RFP are as follows:

1) Background information about the library
   - What are its mission, vision and goals?
   - What services does it offer?
   - What is the size of its collection, circulation and user community?
2) Detailed Statement of needs
   - What are the objectives of the library automation?
   - What are the needs for compliance with standards for a library system?
   - What are the service level requirements?
   - What are the functional requirements?
3) Vendor name and contact addresses and numbers
   - Who are the potential ILS vendors that may satisfy library requirements?
   - How these vendors can be contacted?
   - Who are the third-party service providers for potential open source ILSs?
4) Time frame
   - What are the steps/activities and when should each be finished?
   - What are the priority-level for required activities?
   - What should be the schedule for completion of tasks?
5) Evaluation criteria and method
   - What are the critical factors that must be present?
   - How to frame parameters for evaluating different responses against RFP?
   - What should be the method for evaluating ILS products?
6) Systems requirements and specifications
   - What specific features of the system must be present?
   - What are infrastructural requirements?
   - What are the software-level requirements?
7) Request for quotation
   - What should be the format for quotation?
   - How much will the system cost?
   - What are the conditions for on-site services and updating of software?
   - How to calculate ROI (Return on Investments)?

Steps in the development of RFP

The above-mentioned components of a typical RFP require to be developed methodically through appropriate steps. David, L. T. (2001) prescribed a set of steps for developing RFP in his guide book entitled *Introduction to integrated library systems* published by Information and Informatics Unit, UNESCO

Bangkok, Thailand. The steps are as follows:

1) Needs assessment
2) Studying available ILSs (including open source ILSs)
3) Listing potential vendors of the ILSs (third-party vendors for open source ILSs)
4) Specifying needs and standards compliance
5) Specifying criteria for evaluation for ILSs
6) Developing a time frame for task completion
7) Writing the RFP (with necessary components)
8) Submitting to legal office for comment on contract agreements
9) Rewriting according to the specifications of the legal office
10) Submitting to vendors for requesting proposals
11) Receiving proposals from vendors
12) Evaluating proposals against a set of parameters
13) Preparing a short list of vendors/third-party service providers
14) Requesting a demo of the system
15) Purchasing/commissioning the system
16) Preparing the final contract
17) Implementing the system
18) Evaluating the implemented system.

Experts recommend that the actual evaluation (both software and responses received from vendors and third-party service providers in case of open source ILS) must be done by a team, and not by an individual.

Time frame for completion of steps needs to bet set and follow strictly to achieve targets. David (2001) suggested a time frame for steps to provide standard length of time need to complete each stage of the process. Table 1.3 is an illustration of the time frame developed by Davis (2001) for the RFP and selection processes.

Table 1.3: Time frame for steps in RFP development (source: David, 2001)

Steps	Month 1	Month 2	Month 3	Month 4	Month 5+
Needs assessment	×				
Studying available ILS	×				
Listing potential vendors of the ILS	×				
Specifying needs	×				
Specifying criteria for evaluation					
Developing a timeframe	×				
Writing the RFP		×			

Submitting to legal office for comment		×			
Rewriting according to the specifications of legal office		×			
Submitting to vendors		×			
Receiving proposals from vendors			×		
Evaluating proposals				×	
Preparing a short list of vendors				×	
Requesting for a demo of the system				×	
Selecting your system				×	
Preparing the contract				×	
Implementing the system					×
Evaluating the implemented system					×

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

15) What is need of a RFP in developing automated library system? Enumerate essential components of a typical RFP.

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16) Discuss the steps for developing a RFP as suggested by L. T. Davis.

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1.7 AUTOMATED LIBRARY SYSTEM: TRENDS AND FUTURE

This Unit ends with listing a set of ongoing trends and upcoming changes in automated library system. The issues related with changes have been discussed here in full length and linked with global recommendations in Unit 3 of this Block which deals with library management software. This section attempts to introduce you with the cutting-edge technologies that are going to influence the processes, procedures, architectures and platforms for integrated library systems.

1) **Service-oriented Architecture (SoA) in ILS**

Service-Oriented Architecture (SOA) is an ICT architectural style that supports seamless flow of information, which is independent of systems, platforms, software architecture, data structures etc. In short it supports sharing of services and datasets in heterogeneous information infrastructure. The term service-orientation indicates a way of thinking in terms of services, service-based development and the outcomes/deliverables of services. SoA is now established as a mature architectural style and the ILSs have started switching to this promising architectural style to provide end users innovative library services and opportunities to other libraries to utilise resources and services (through application program interface). The SoA is an essential attribute of an ILS to support Cloud Computing. It facilitates the effective use of the Cloud.

2) **Cloud-based library automation**

Cloud computing is network based computing facilities that support on-demand use of hardware and software resources. Libraries can take advantages of cloud computing in the following ways:

i) using ILS available in remote server through web browser without any installation;

ii) hosting the Web-OPAC and staff interfaces in remote server without burden of local management of server and arrangement of IP address and domain name;

iii) setting up own remote file storage and database system (with scheduled backups).

The cloud computing mainly supports three facilities. These are Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). The Cloud based library automation has following advantages:

i) Resource pooling (cloud computing providers provides a vast network of servers and hard drives for use by client libraries);

ii) Virtualisation (libraries do not have to care about the physical management of hardware, software, user interface, data backup and hardware compatibility);

iii) Elasticity (addition of storage space on-demand in hard disk or increasing server bandwidth can be done easily);

iv) Geographical scalability (cloud computing allows libraries to replicate data to several branch libraries world-wide);

v) Automatic resource deployment (libraries only needs to choose the types and specifications of the resources required and the cloud will configure it automatically);

vi) Metered billing (library will be charged for only what they use).

As a whole cloud-based library automation is quite useful and cost effective for small and medium sized libraries. Large-scale libraries may offer datasets on the cloud for use by small libraries (Data as a Service (DaaS)). Some of the well-known cloud-based services are listed in Table 1.4 for your ready reference.

Table 1.4: Cloud platform, systems and services

Cloud platform	Cloud systems	Cloud services
Software as a Service (SaaS)	Server Virtualisation, Open URL resolver, Application software	GoogleDoc, GoogleApps, OpenID, Adobe
Platform as a Service (PaaS)	Cloud based ILS, Inter Library Loan	LibLime, OSSLab, N-LARN project in India, Polaris, Exlibris
Infrastructure as a Service (IaaS)	Discovery services, Digital repository, Web hosting, Storage	Amason Elastic Compute Cloud (EC2), Amazon Simple Storage Solution (S3), Dropbox Cloud storage

The major cloud service providers and related services are listed in Table 1.5.

Table 1.5: Cloud providers and services

Cloud providers	Types of services
Amazon Web Services	IaaS, PaaS, SaaS
EMC	SaaS
Eucalyptus	IaaS open source Software
Google	PaaS (AppEngine), SaaS
IBM	PaaS, SaaS
Lincode	IaaS
Microsoft	PaaS (Asure), SaaS
Rackspace	IaaS, PaaS, SaaS
Salesforce.com	PaaS, SaaS
VMware vCloud	PaaS, IaaS

3) Linked Open Data (LOD)

Linked Open Data (LOD) refers to publishing and connecting structured data on the Web for use in public domain. The three Key technologies that support LOD are: URI (Uniform Resource Identifier, a generic means to identify entities or concepts in the web), HTTP (Hypertext Transfer Protocol, a simple yet universal mechanism for retrieving resources, or descriptions of resources over the web), and RDF (Resource Description Framework, a generic graphical data model to structure and link data that describes things in the web). Linked Open Data (LOD) has two basic purposes:

i) publish and link structured data on the Web; and

ii) create a single globally connected data space based on the web architecture.

Tim Berners-Lee advocated four rules for converting dataset to LOD. These are:

1) Use URIs as names for things;

2) Use HTTP URIs so that people can look up those names;

3) When someone looks up a URI, provide useful information, using the standards (RDF, SPARQL); and

4) Include links to other URIs, so that they can discover more things.

W3C established Library Linked Data Incubator Group in 2011 "to help increase global interoperability of library data on the Web, by bringing together people involved in Semantic Web activities — focusing on Linked Data — in the library community and beyond, building on existing initiatives, and identifying collaboration tracks for the future." Libraries may utilise bibliographic data, authority data, classification schemes, vocabulary control devices etc. available as LOD for enriching existing library services and for introducing new information services. Some major examples of library LOD are – AGROVOC multilingual structured and controlled vocabulary, British National Bibliography (BNB) published as Linked Data, VIAF, LCSH, LC Name Authority File (NAF) provides authoritative data, MARC country, and language codes, Dewey.info etc. ILSs are taking advantages of integrating LOD available in library domain through appropriate APIs. For example, the cataloguing module of Koha can be linked with VIAF (Virtual Internet Authority File – a linked dataset of authority data from 21 major national libraries of the world) for getting authority data automatically to control name authority in local library catalogue.

4) Web-scale library management

Web-scale library management service is essentially, a cloud based solution developed by OCLC. In this service OCLC member libraries are not only getting shared computing infrastructure but also shared data from WorldCat. OCLC is successfully mixing four basic elements of cloud computing i.e. IaaS, PaaS, SaaS and DaaS (see cloud computing section above). There has been a change in trends of library automation. It is no longer about which library provides the largest collection but about which library can provide their community with the best means to access the materials they need, regardless of location (OCLC, 2011). Libraries can increase visibility at the global scale and accessibility to services at the wider scale by using the new Web-scale library management facility.

The architecture of OCLC's Web-scale library management is given in Fig. 1.3.

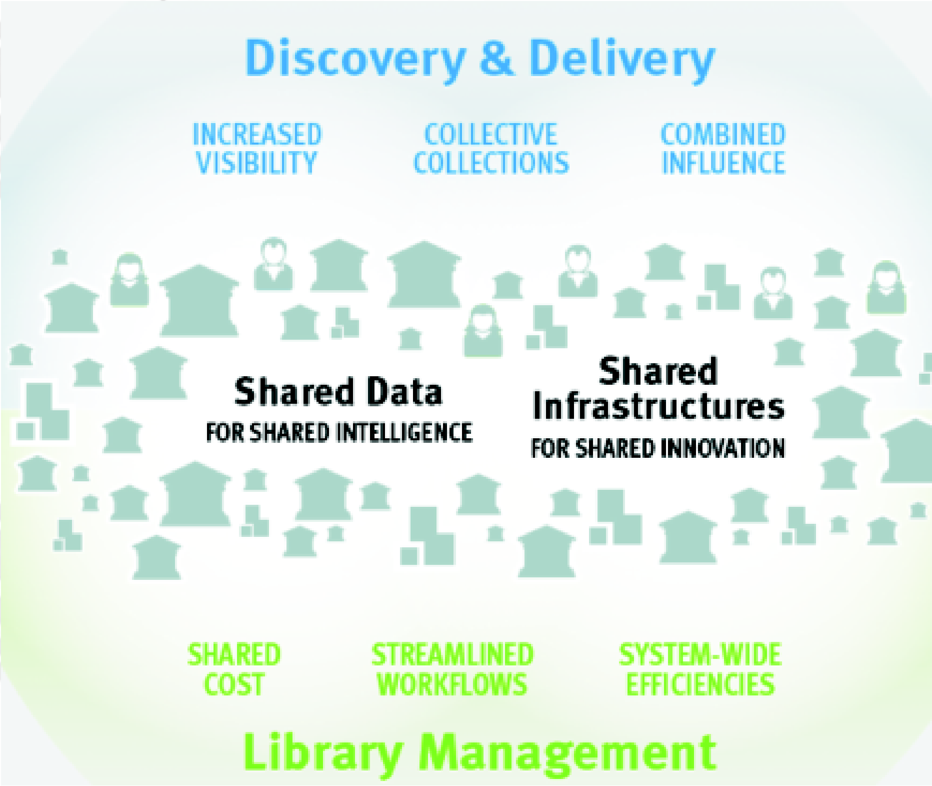


Fig 1.3: Web-scale Library System

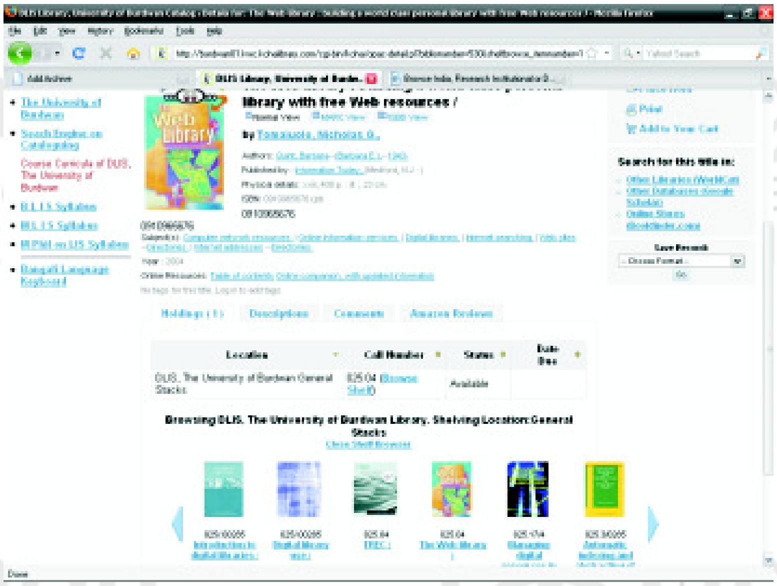
Source: OCLC (2011), Libraries at web-scale, Dublin, p. 23

5) Web 2.0 compliant ILS

The present web (often referred as web 1.0 in blogsphere) is progressing towards a User-centred entity with the support of an advanced set of technological tools that are collaborative, interactive and dynamic in nature. Radfar (2005) identified following characteristics of web 2.0 – i) a platform enabling the utilisation of distributed services; ii) a phenomenon describing the transformation of the web from a publication medium to a platform for distributed services; and iii) a technology that leverages, contributes, or describes the transformation of the web into a platform for services. ILSs are all set to take advantages of participative architecture of the web and introducing new services like user tagging of subject descriptors, ratings of documents by users, RSS feed for search query, integration with web 2.0 services like read/write web, collaborative web, social networking tools and information mashup. This new trend ILS is also termed as ILS 2.0.

6) Information mashup

Information mashups tools allow remixing of data, technologies or services from different online sources to create new hybrid services (O'Reilly, 2005) through lightweight application programming interface (API). ILS uses information mashup in managing and integrating virtual contents distributed globally with local library resources. Information mashups are becoming popular application of Web 2.0 around the world such as KohaZon (integration of Koha OPAC with Amazon services), WikiBios (a mashup where user can create on-line biographies of each other in a Wiki setup), LibraryLookup (integration of Google maps with library directory service in UK) and many more such instances.


File Edit View History Bookmarks Tools Help
library with free Web resources /
Print
Add to Your Cart
Search for this title in:
Save Record
Holdings (1)
Descriptions
Comments
Amazon Reviews

Location	Call Number	Status	Date Due
DLIS, The University of Burdwan General Stacks	025.04 (Browse Shelf)	Available	

Browsing DLIS, The University of Burdwan Library, Shelving Location: General Stacks

Fig. 1.4: KohaZon: Mashup of Koha with Amazon

7) Interactive user interface: OPAC 2.0

Most of the ILSs now support web-OPACs. OPAC 2.0 is the next generation web-OPAC where users can interact, collaborate and participate in library workflows such as describing resources (folksonomy), tagging subject descriptors, rating of documents, creating personalised information environment, posting on library blog, suggesting new documents, commenting on library services, publishing book reviews, posting likes on facebook for library books and many such facilities. ILSs are increasingly taking advantages of web 2.0 technologies and services to convert static OPAC into dynamic OPAC 2.0.

8) New cataloguing standards

Document description models and standards are changing rapidly. We have now E-R (entity-relationship) based bibliographic data model known as FRBR (Functional Requirements for Bibliographic Records, developed by IFLA in 1998) in place of flat data structure of ISBD. Similarly FRAD ((Functional Requirements for Authority Data, developed by IFLA in 2009), FRSAR (Functional Requirements for Subject Authority Records, developed by IFLA in 2010) are now established data models for managing name authority and subject authority respectively. These changes call upon necessary data structures in ILSs to suite FRBR, FRAD and FRSAD. Both commercial ILS group (e.g. Vitua ILS from VTLS group) and open source ILS group (e.g. Koha) are in the process of implementing the structural changes to address the improvements in cataloguing.

9) Application of discovery tools

Uses of discovery tools are increasing in libraries. Discovery tools, powered by federated search mechanisms, allow library patrons to perform concurrent searching in the library catalogue (metadata level), journal articles (full-text level), electronic theses and dissertations, consortia databases, public web, open access repositories, union catalogues etc. through a single-search interface with a set of feature-rich tools to support users. Discovery tools – i) can be integrated with existing library OPAC; ii) can import metadata into one index; iii) can apply one set of search algorithms to retrieve and rank results. As a result these tools support rich user experiences in terms of speed, relevance, and ability to interact consistently with results. Moreover, the unified interface is a big boost for users as they no longer need to choose a specific search tool to begin their search. These tools are available commercially (e.g. EBSCO Discovery Service) and also as open source products (such as VuFind, SOPAC, Blacklight, OpenBib etc.).

10) **Digital media archiving module**

The distinction between automated library system and digital library is blurring day-by-day. This is because of the fact that most of the ILSs are integrating digital media arching module or DMA (e.g. NewGenLib 3.0 onwards) to handle full-text discovery of documents in different formats. This trend of ILS is important in the sense that in future library can handle both automated and digital library systems through a single instance of ILS. Another advantage of DMA is the scope to integrate courseware in multimedia formats in case of academic libraries. Some ILSs are also achieving compatibility with OAI/PMH standard to support metadata harvesting in ILS (e.g. Koha version 3.10.1 onwards).

11) **Community information services as outreach process**

Community information services meant to support community members with the information originated in the community. The service includes three broad groups – survival information such as that related to health, housing, income, legal protection, economic opportunity, political rights etc.; citizen action information required for effective participation as individual or member of a group in the social, political, legal, economic process; and local information i.e. basic information concerning courses, educational facilities, government agencies, local organisations, fractional groups, health professionals etc. including a calendar of local events. ILSs now (e.g. Vitua ILS and Koha are supporting MARC 21 community information format to handle community information resources) are trying to include community information service module to extend the role of ILS to provide outreach services.

12) **Increasing use of open source software**

The domain of library and information science, right from the beginning of the open source movement, is benefitted through structured effort and software philanthropy. We have matured ILSs like Koha (comparable to any global ILS), Evergreen, Emilda, NewGenLib; comprehensive digital library software like DSpace from the MIT, US (with support from HP), Greenstone Digital Library Software (or GSDL) from University of Waikato (presently supported by UNESCO). Use of open source ILSs are increasing all over the world because of the transparent use of library standards and scope of customisation to suite the specific requirements of a library. Moreover commercial ILSs are also utilising open source components like MARCEdit & ISISMARC (MARC cataloguing tools), YAS toolkit (Z39.50 client and server), Lucene & Solr (Text retrieval engines), Unicode-compliant multilingual tools etc. The use of open source software in library automation ensures 3F – fund (as these are free of cost), freedom (as these are free to customise) and fraternity (as these are supported by international communities).

13) **Emergence of open standards**

Open standards are available in public domain. These are the standards that anyone can incorporate into their software, service and system. MARC record standard is possibly the most visible open standard in the domain of library services. Library systems of any type or size are required to be compatible with global standards to achieve interoperability. Here lies the importance of open standards. These are developed, approved and maintained via collaborative process to facilitate exchange of datasets. These standards are available at no cost, well-documented, transparent and free from any kind of use restriction. ILSs are increasingly depending on open standards such as MARC 21 family of standards (Five standards), OAI/PMH, CCL (Common Command Language), SING, Dublin Core metadata standard, SRU, SRW, OpenURL, MARC-XML, METS, MODS etc.

14) **Interoperability capabilities**

Interoperability refers to communication between systems (external interaction) or system parts (internal interaction). Libraries are now operating in distributed information environment and many library systems communicate electronically with sources of bibliographic records (publisher or cataloguing agencies), book vendors, and users. They also now interconnect themselves with networked information resources outside of the library and deliver these through library-maintained interfaces (e.g. inter library loan, distributed cataloguing, metadata harvesting etc.). ILS developers are aware of these facts and thereby supporting more and more interoperability standards in different modules of ILSs.

15) **Multi-lingual records management through Unicode**

Multilingual (including Indic scripts) information processing requires standard text encoding scheme (such as Unicode), which can store, process and retrieve regional language based documents. But creation of multi-script databases requires not only Unicode-compliant operating system (OS) and other application programmes such as Virtual Keyboards to enter multi-script records, Open Type Fonts (OTF) to support extended character sets and layout features, and Rendering Engines to display script specific conjuncts and ligatures properly (Mukhopadhyay, 2006). ILSs are trying to support Unicode (especially UTF-8) to store native character sets, integrated virtual keyboard and supportive text retrieval engines to ensure processing and retrieval of multilingual documents.

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

17) Write in brief the trends in the development of ILSs.

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18) What is cloud computing? How is it to going to help libraries?

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1.8 SUMMARY

Library automation is an area from where future benefits will emerge. It means that if a library is not automated it won't be in a position to take the advantages of ICT-enabled library services in future. This Unit acts as foundation and aims to introduce you with the concept of integrated library system and the advantages associated with it. It covers historical and theoretical foundations of library automation supported by a timeline of development of related technologies. In this Unit you can find guidance – 1) to identify the requirements for library automation; 2) to follow model for integrated library system; 3) to differentiate automated and digital library system; 4) to understand the typical steps for accomplishment of library automation; 5) to appreciate needs for standards in ILS and to recognise essential standards that need to be ensured; 6) to identify features of ILS in rapidly changing technological environment. This unit also provides knowledge about emerging global recommendations for developing ILS in the context of cutting edge technologies like cloud computing, linked open data and web scale library management. It also covers roles and components of RFP and steps for developing RFP for library automation, and allows you to develop skills in preparing RFP. This unit ends with a brief discussion on forthcoming features and ongoing changes in the arena of ILS against a fifteen-point checklist.

1.9 ANSWERS TO SELF CHECK EXERCISES

1) Library automation is the generic term that denotes applications of Information Communications Technologies (ICT) for performing manual operations in libraries of any type or size. It supports three broad groups of library activities – i) housekeeping operations; ii) information retrieval; and iii) on-the-fly integration of library materials with open datasets. Library automation requires for – 1) increased operation efficiencies; 2) betterment of library services; 3) innovative information services; 4) wider user access and 5) more productive use of library staff.

2) An ILS is capable of managing the operations of more than one basic library functions by sharing the files in the server to perform them. For example data from the book catalog master file and the patron master file can be retrieved and used in the circulation module to perform the circulation function of the ILS. In such systems files are interlinked so that deletion, addition and other changes in one file automatically activate changes in related files. It means integrated library management system is sharing a common database to perform all the basic functions of a library.

3) Library automation is a generic term that refers to the application of computers in libraries to automate operations. It can be standalone system supporting only one module like cataloguing or it can be integrated to link all modules or library subsystems through a common shared database. On the other hand, ILS is an automated library system that utilises shared data and files to provide interoperability of multiple library functions, e.g. cataloging, acquisition, circulation, serials, etc.

4) There are five generations of library automation categorised on the basis of technological breakthroughs. Alternatively these are also called five ages of library automation. The first age is characterised by the introduction of PCs in library automation and the second age is dominated by LAN based ILSs. The third age is marked by the Web-enabled ILS and the fourth age is featured by integration of full-text digital objects in ILS. The fifth and the present age is characterised by cutting edge technologies like cloud computing, linked open data and web 2.0 features for interactive user interfaces.

5) Library automation initiated in 1930s and applied in large scale in 1970s with the availability of low-cost PCs. The decade of eighties witnessed application of global standards and local area networks in library automation with the advent of campus-wide ILS and relational database architecture. The decade of nineties is dominated by the application of web technologies in library automation. Technologies like CGI architecture, Web-OPAC, digital media archiving are some of the well known features of this decade. The first decade of 21st century is the decade for application open source software, open standards and extended web technologies like web 2.0, cloud computing and linked open data in library automation.

6) The chronological order of the technological breakthroughs in the domain of library automation is as follows – i) Low-cost PCs used in 1970s; ii) LAN-based ILS with relational database backend, global exchange format and client-server architecture; iii) use of web technologies to provide time-space independent user services including Web-OPAC; iv) digital media archiving, interoperability standards and open source software; v) interactive user interfaces and seamless integration of linked open data.

7) Library automation has manifold advantages. Automation of library housekeeping operations is considered as an especially critical area from which future benefits will emerge. It means that if a library is not automated it can’t take advantages contributed by ICT such as digitisation, web-enabled library system, use of linked open data, remote management of library, interactive user services etc. Library automation ensures acceptability of library to new generation users.

8) Library management software or ILS forms the core component of library automation. An ILS should support all the basic activities of library, seamless integration in different modules, global and national standards in the domain, suitable software architecture, interoperability standard data formats, multilingual processing and retrieval, and integration with open datasets. ILSs need to be future friendly, user friendly and open for customisation.

9) Procedural model of library automation is proposed by ASLIB (Association of Information Managers, UK) as a general model for automating library housekeeping operations. Presently most of the ILSs follow this model for designing different functional modules of ILSs. The model proposes that a library system has mainly two subsystems – administrative subsystem and operational subsystem (amenable for automation). The operational subsystem may be divided into four further subdivisions namely Acquisition, Processing, Use and Maintenance. Within each of these divisions there are a number of procedures (eighteen in total) and within each procedure there are one or more of six possible activities. The procedures and activities are carried out by fifteen basic tasks.

10) Digital libraries are managed collection of digital objects that provide full-text access to resources and differ significantly from automated library systems in terms of – 1) search features (metadata only vs. full-text and metadata); 2) document description (MARC 21 vs. Dublin Core); 3) interoperability standards (Z39.50 vs. OAI/PMH); and 4) software architecture (centralised vs. distributed).

11) Standard is a specification accepted by recognised authority as the most practical and appropriate current solution of a recurring problem. Establishing order to chaos and building collaboration are two most important prerequisites for effective information services. Both of these requirements depend on shared understanding i.e. on standards. Libraries all over the world are entering into the next wave of development to meet volume and variety of users' information demands. Interoperability and interactive user interface are two buss words in developing global information infrastructure. Libraries are no exceptions. Automated library systems are trying to be compatible with globally agreed upon standards related with information processing such as data formats (MARC 21 data formats, CCF, UNIMARC); interoperability standards (ISO 2709, MARC-XML, Z39.50, SRW, SRU OAI/PMH) and character encoding standards (Unicode).

12) ILSs support three broad groups of library activities – i) housekeeping operations; ii) information retrieval; and iii) on-the-fly integration of library materials with open datasets. A typical ILS supports selection, ordering, acquisition, processing, circulation, serials control, dissemination of information services and also extends help in library administration, planning and decision making process as a MIS tool.

13) Designing of future friendly ILS requires guidelines. OLE project and ILS-DI recommendations are acting as such guidelines recognised globally. The principal aim of OLE project is cost-effective integration of library management with other institutional systems on the basis of Enterprise Resource Planning (ERP) enabled Abstract Reference Model. On the other hand, ILS-DI guides developers in – 1) Data aggregation (harvesting and distributed searching); 2) Search (simple and advance search operators); 3) Patron services (general and interactive interfaces); and 4) Integrated service framework (on-the-fly integration of open contents, data sets etc.).

14) A request for proposal (RFP) is a formal request for a bid from suppliers of library systems or third-party software vendor in case of open source

software. RFPs are aiming to determine library requirements, prescribing standards and demanding services from ILS vendors and developers. The RFP prescribes the resources that need to be acquired, the services that need to be offered, the standards that need to supported, the selection criteria for ILS, and the requirements for the software vendor including a time schedule for each level of activities. It guides the library in evaluation of integrated library systems and helps the library to choose and acquire the most appropriate system.

15) RFP is required to guide us in framing requirements, selecting ILS and implementing ILS. The components of a typical RFP includes: 1) library profile; 2) automation need profile; 3) vendor profiles; 4) time frame; 5) evaluation parameters and method; 6) system requirements and specifications; 7) format for proposal.

16) L. T. David in 2001 advocated a set of steps for developing RFP. The process starts with need assessments and ends with evaluation of implemented system. It includes a total of eighteen steps.

17) The rapidly changing technological environment leads to corresponding changes in the development of ILS. The influence of technologies leads to the development of ILSs from stand-alone system to web-enabled systems in five decades. The major trends that are influencing ILSs presently are web architecture, Unicode-compliant processing and retrieving environment, supports for interoperability standards, open source movement and cutting edge technologies like cloud computing, web scale platform, web 2.0 and linked open data.

18) Cloud-based library automation is quite useful and cost effective for small and medium sized libraries. Cloud computing is network based computing facilities that support on-demand use of hardware and software resources. Libraries can take advantages of cloud computing in the following ways – i) by using ILS available in remote server through web browser; ii) by hosting the Web-OPAC in remote server; iii) by setting up own remote file storage and database system (with scheduled backups).

1.10 KEYWORDS

Acquisition : The process of obtaining resources for the library's collection, typically including ordering, receiving and payment.

API : Application Programming Interface. A language and message format used by an application program to communicate with the operating system or some other control program such as a database management system (DBMS).

Authority record : A record that shows the preferred form of a personal or corporate name, geographic region or subject. It also includes variant forms of the preferred form as cross references.

Barcode : A printed code, consisting of lines and spaces that can be read by a bar code scanner (reader), affixed to physical materials in a library collection to identify particular items for tracking and circulation.

Bibliographic identifier: A unique identifier which unambiguously identifies a bibliographic record within an ILS catalog and is assumed to persistent, at least as long as the records are managed within the ILS.

Bibliographic metadata: Information about a resource that serves the purpose of discovery, identification and selection of the resource. Includes elements such as title, author, subjects, etc.

Discovery application: A computer application designed to simplify, assist and expedite the process of finding information resources.

Dublin Core : A fifteen element metadata set for use in resource description intended to facilitate discovery of electronic resources.

EDI : Electronic Data Interchange (EDI) is a standard method for exchanging structured data, such as purchase orders and invoices, between computers to enable automated transactions.

EDIFACT : EDI For Administrations, Commerce and Transport The concept of utilising a single set of specifications for bibliographic records regardless of the type of material they represent.

ERMS : Electronic Resources Management System is used to manage a library's electronic resources, primarily e-journals and databases. Systems can include features to track trials, license terms and conditions, usage, cost, and access.

FRBR : Functional Requirement for Bibliographic Records is a conceptual model for the aggregation and display of bibliographic records. FRBR is an entity-relationship model, with four primary entities - work, expression, manifestation, and item - which represent the products of intellectual or artistic endeavor.

ILL : Inter Library Loan (ILL) is the process between two libraries of borrowing and lending a physical bibliographic item, or obtaining a copy of it.

ILS : An automated library system that utilises shared data and files to provide interoperability of multiple library functions, e.g. cataloging, acquisition, circulation, serials, etc.

Interoperability : The ability for two different computer systems to communicate and exchange information in a useful and meaningful manner.

LAN : A digital communication system capable of interconnecting a large number of computers, terminals and other peripheral devices within a limited geographical area.

Library Automation: Library automation is the mechanisation of housekeeping operations and information handling mainly by using computer and communication technologies.

MARC 21 : A harmonised MARC format developed by LoC in 1999 for encoding standards related to bibliographic data, authority data, holdings data, classification data and community information. It is used for the communication and exchange of bibliographic information (mentioned earlier) between computer systems.

MARCXML : A metadata scheme for working with MARC data in a XML environment.

Metadata : Structured information that describes an information resource. “Data about data” for an information bearing object for purposes of description, administration, legal requirements, technical functionality, use and usage, and preservation.

Metadata harvesting: A technique for extraction of metadata from individual repositories for collection into a central catalog.

Module of ILS : Functions specific to a particular system capability such as the online public access catalog, cataloging, acquisitions, serials, circulation, etc.

NCIP : NISO Circulation Interchange Protocol (NCIP) is a standard which defines a protocol for the exchange of messages between and among computer-based application to enable them to perform functions necessary to lend and borrow items, to provide controlled access to electronic resources, and to facilitate co-operative management of these functions.

Network : A group of computers and other devices connected together so that they can communicate with each other, share data and resources such as printers, and perhaps share the workload of running complex programs. They may have one or more central servers to coordinate and run things, or all devices may be of equal standing (called “peer-to-peer”). The connections between them may be physical wires and cables, or wireless using infrared or radio frequency.

OAI-PMH : OAI - Protocol for Metadata Harvesting. Protocol for application-independent interoperability framework based on metadata harvesting, open standards HTTP (Hypertext Transport Protocol) and XML (Extensible Markup Language).

OPAC : On-line Public Access Catalog is a library catalog which can be searched on-line and is a module of the ILS. It is the interface between library resources and users and is designed to be "user friendly."

Open Source : A concept through which programming code is made available through a license that supports the users freely copying the code, making changes it, and sharing the results. Changes are typically submitted to a group managing the open source product for possible incorporation into the official version. Development and support is handled cooperatively by a group of distributed programmers, usually on a volunteer basis.

Open Search : A collection of technologies developed by Amason that allow publishing of search results in a format suitable for syndication and aggregation.

Open URL : A URL with stored metadata that is user context sensitive in what information or hypertext link is delivered.

Protocol : A standard procedure for the message formats and rules that two computer systems must follow to communicate with each other.

RSS : Really Simple Syndication is an XML format used for distribution or syndication of frequently updated Web contents.

SIP2 : Standard Interface Protocol Version 2 is a standard for the exchange of circulation data and transactions between different systems.

SRU : Search/Retrieve via URL is a standard search protocol for Internet search queries, utilising CQL (Common Query Language), standard query syntax for representing queries.

SRW : Search/Retrieve Web service is web services implementation of the Z39.50 protocol that specifies a client/server-based protocol for searching and retrieving information from remote databases.

System Analysis : A powerful technique for the analysis of an organisation and its work.

Unicode : A universal character-encoding standard used for representation of text for computer processing. Unicode provides a unique numeric code (a code point) for every character, no matter what the platform, no matter what the program, no matter what the language. The standard was developed by the Unicode Consortium in 1999.

WAN : A computer networking system that operates nationwide or worldwide by utilising telephone line, microwave and satellite links. It is also used to interconnect LANs.

Web Service : Software system designed to support interoperable machine to machine exchange of data/information, typically using the XML, SOAP, WSDL and UDDI open standards.

XML : eXtensible Markup Language is an open standard for describing data from the World Wide Web Consortium. It is used for defining data elements on a Web page, business-to business documents, and other hierarchically structured text and data.

Z39.50 : A NISO and ISO standard protocol that specifies a client/server-based protocol for cross-system searching and retrieving information from remote databases. It specifies procedures and structures for a client system to search a database provided by a server.

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UNIT 2 LIBRARY AUTOMATION PROCESSES

Structure

2.0 OBJECTIVES

After going through this Unit, you will be able to:

- understand typical workflows of library subsystems amenable for automation;
- know how to analyse housekeeping operations systematically;
- identify the requirements, processes and advantages of automating library workflow; and
- realise issues related to administration of library automation processes.

2.1 INTRODUCTION

You already know what and why of library automation from Unit 1. This Unit aims to introduce you with the processes related to library automation in an integrated environment. You can also see here the application of procedural model of library automation in analysing tasks related to different subsystems of a library. One of the major objectives of library automation is to automate the regular workflow of library system i.e. library housekeeping operations. An ILS performs library housekeeping operation through software modules integrated seamlessly. These modules are also called subsystems under ILS. A typical ILS includes acquisition subsystem, document processing subsystem, serials control subsystems and circulation subsystem as core modules. The other managerial activities like export/import, backup/restoration, parameters setting, configuration settings etc. are performed through administrative module.

2.2 LIBRARY WORKFLOW: SYSTEM APPROACH

Automation of library housekeeping system requires the analysis of workflow and activities into their atomic structure. This process is called system analysis. You already know about Procedural Model of library automation proposed by ASLIB (now Association of Information Managers, UK). The sub-section 1.3.3 of Unit 1 covers procedural model of library automation at length. This model acts as a base for system analysis of library housekeeping operations. The procedural model proposes two basic subsystems, four operational subsystems, three levels, eighteen procedures, six activities and fifteen basic tasks as library workflow irrespective of the type and size of libraries (see Text box 1 and Table 1 in sub-section 1.3.3 of Unit 1). The summary table is given below.

Table 2.1: Library workflow

- **Library System**
  - **Four Operational Subsystems** (Acquisition, Processing, Use, Maintenance)
    - **Eighteen procedures** (Acquisition: Select, Order, Receive, Accession; Processing: Classify, Catalogue, Label, Shelve; Use: Locate, List, Issue, Reserve, Return, ILL, Photocopy; Maintenance: Bind, Replace, Discard)
      - **Six activities** (Initiate, Authorise, Activate, Record, Report, Cancel**)**
        - Fifteen tasks (pass, receive, discard, place, remove, search, duplicate, attach, separate, move, sort, read, verify, enter and decide)

2.2.1 Subsystems and Workflows

This section covers the workflow of the subsystems of integrated library system.

A) **Acquisition Subsystem**

The acquisition of documents is a prerequisite for libraries. A library should acquire and provide all the relevant documents to its users so that the basic functions of the library are fulfilled. An acquisition subsystem shall perform four basic procedures – Select, Order, Receive and Accession. The scopes of these procedures are as follows:

Procedures in Acquisition Subsystem

Select

Selection of documents for library users is a very responsible job and should be based on definite principles. It is done with the help of selection tools (such as bibliographies, publishers' catalogues, trade catalogues etc.) and requests/suggestions from library users/authority. Selection of documents to be procured in the library is followed by the formal sanction of the competent authority/library committee.

Order

This procedure starts with pre-order searching, especially to avoid duplicate orders. In the next stage purchase orders are generated and placed either directly to the respective publishers or to the listed vendors/book sellers. Additionally, generation of reminders for overdue items and cancellation of orders also comes under the purview of ordering procedure.

Receive

Documents and invoices or bills usually arrive together. Bills are checked with the order list before processing for payment. Newly arrived books are tallied with the bills and the order list to check the author, title, edition, imprints and price before accessioning.

Accession

A stock register is maintained by libraries in which all the documents purchased or received in exchange or as gift are entered. Each document is provided with a consecutive serial number. The register is called Accession register and the serial number of the document is referred as Accession Number.

All the above-mentioned procedures and related activities of the acquisition subsystem can be mechanised through library management software. In such a system these basic activities are linked with the files of publishers, suppliers, budget & fund accounting, currency etc. to achieve the benefit of integrated library system.

B) Processing Subsystem

The processing procedure is the pivot round which all the housekeeping operations revolve in a library. It helps in the transformation of a library collection into serviceable resources. The procedures under this subdivision are classification, cataloguing, labeling and shelving.

Procedures in Processing Subsystem

Classify

The followings are the major classification schemes, which are used in various libraries of the world: Dewey Decimal Classification Scheme (DDC), Universal Decimal Classification Scheme (UDC), Library of Congress

Classification (LC), Colon Classification (CC), and Subject Classification (SC) etc. Classification is a mental process and demands intellectual exercises from classifier. As a result, automatic synthesis of class numbers requires the application of Artificial Intelligence (AI) techniques in development of software. The present edition of DDC is also available in CDROM and known as WebDewey.

Catalogue

Cataloguing is the prime method of providing access to the collection. Cataloguing procedure starts with technical reading of the document to be catalogued by studying title, sub-title, alternate title, author, editor, edition, reprint, imprint, dedication, preface, table of contents, collation, series, bibliographies etc. In case of manual cataloguing, the cataloguer makes separate cards for author, title, subject, cross-references and analytical entries by following any standard catalogue code (such as AACR II, CCC etc.) and file them as per the rules laid down by the library. Computerised cataloguing begins with entering bibliographical data in a pre-designed worksheet. The worksheet or data sheet is very similar to data entry form and is based on any standard content designators scheme (such as MARC 21 Bibliographic Format, CCF/B, UNIMARC etc.). Finally bibliographical data recorded in the worksheets are entered into the computer to produce machine-readable catalogue file and OPAC. Computer-based cataloguing supports importing of bibliographical datasets for the library resources either from centralised cataloguing services or from other libraries and exporting of bibliographical data of its own collection to other library systems. This facility reduces unit cost of cataloguing and ensures standardisation in cataloguing. The recent trend of cataloguing is to utilise Z39.50 protocol to download bibliographical data from other libraries and to provide global access to its own collection through Web-OPAC.

Label

It is the work of pasting various labels on different parts of a document. The following labels are generally pasted in books:

Spine label: This is done to make call number (a combination of class number and book number) properly visible to the users when the book is shelved. The size of the label is in the range of 1.25” × 1.25”.

Ownership slip/mark: These are generally pasted on the inner side of the front cover at left hand top most corner. Ownership marks are put at various parts of a document by rubber stamps. The size of slip is 3” × 2.5”.

Date slip: It is pasted on the top most portion of the front or back flyleaf of each book. The size of date slip is 5” × 3”.

Book pocket: On the bottom of the inner right side of the front or back cardboard cover a book pocket is pasted.

Book card: One printed/hand-written book card of size 5” × 3” is put in the book pocket of each book.

In a computerised environment, various labels are printed by using library management software. In case of barcode based computerised circulation, accession numbers of documents are converted into barcodes and printouts of barcodes are pasted on the inner back cover of documents.

Shelve

Shelving is the arrangement of documents on the shelves to fulfill the fourth law of library science – Save time of the reader. Generally books are arranged on the shelves in a classified manner as per the call number. Bound periodicals are generally shelved alphabetically by title and then by volume numbers. Although shelving works are generally manual in nature, RFID-enabled ILS helps in identifying misplaced documents in shelves and thereby supports stock rectification.

C) Circulation Subsystem

Circulation service is quite common to libraries of different types. Most libraries lend books and other library materials to be read elsewhere by users. This is convenient for the users, increases the use made of libraries' collection and reduces demand for reading space within library building. This function requires some sort of record keeping arrangement of what has been lent and to whom. There are two good reasons for keeping loan records: i) to reduce the loss of library materials; and ii) to help library staff to answer users' queries about the location of items not on the shelves.

Procedures in Circulation Subsystem

A rich variety of systems of record keeping of loans have arisen out of such needs and these are known as circulation systems. These include some common jobs for successful operations such as enrollment of members, issue and return of library documents, reservation of documents, renewal of documents, maintenance of documents and records, maintenance of statistics, interlibrary loan, issuing of gate pass, calculation and collection of fines for overdue documents etc. In a computer based circulation system, the machine-readable file consists of records for all items on loan from the library is updated periodically with new records. This file is called "transaction file" and it takes required data from other two files – "document file" and "borrower file". Modern library management software support barcode based circulation system. In such a system a barcode reader scans barcoded accession number of a document and the barcode in turn acts as a pointer to the document file. It helps to minimise labour and error in data entry operation. The concept of RFID (Radio Frequency IDentification) based circulation system is emerging rapidly in developed countries. It comprises three components: a tag, a reader and an antenna. The tag contains important bibliographical data. The reader decoded the information stored on the chip after receiving it through the antenna and sent data to the central server to communicate library automation system. RFID technology supports patron self-checkout machines and has the ability to conduct inventory counts without removing a single book from the shelve. As a whole, RFID improves library workflow, staff productivity and customer service with these attributes.

D) Serials Control Subsystem

Serials in general and periodicals in particular are essential for research and development (R & D) activities. These are the primary means of communication for the exchange of scientific information. The periodicals or journals subscribed by libraries can be grouped into these categories: i) Indexing/Abstracting periodicals; ii) Periodicals containing news items; and iii) Periodicals containing full-text research articles and technical papers. Acquisition of serials/periodicals in a library is different from book ordering system. In contrast to books, the libraries regularly subscribe periodicals against advance payment. The modes of subscription of periodicals in a library are as follows – Through local vendors/subscription agents, Through foreign vendors/subscription agents, Direct from the publishers, As gift or Complementary, Through membership and In exchange.

Procedures in Serials Control Subsystem

The workflow of any serials control system, manual or mechanised, can be listed as below:

- Selection of serials
- Selection of subscription mode
- Formulation of terms of procurement
- Selection of vendors
- Order
- Advance payment
- Receiving and registration of serials issues in kardex
- Sending reminders in case of non-receipted issues
- Adjustment of advance payment for missing issues
- Preparation of list of subscribed journals, new arrivals and serials holdings for consultation by users
- Binding and accessioning of back volumes of serials
- Article indexing (optional).

In an automated system all these tasks are performed by library management software efficiently. It reduces workload of library staff. Automated serials control systems may be predictive or non-predictive. Predictive systems predict the arrival of individual journal issues and can generate reminders in case of non-receipted issues. Prediction means the ability to inform that a named issue of a named journal will arrive in the library within a stated time interval. Modern library management software supports predictive mode of serials control with the facilities of on-line acquisition and access to journals through publishers' portals or library consortia (like UGC Infonet in university libraries in India, N-LIST in colleges under UGC, India and INDEST for IITs, NITs and IIMs). In case of consortia-based access to journals, a library does not perform activities like acquisition, processing and shelving rather optimise user access to the on-line journals. The access interface may be a simple list (by publisher or by journal title) or may be a complex portal with facility for federated searching.

E) Maintenance Subsystem

If we don't take proper care to organise and administer the library documents regularly, these documents would become unserviceable resources immediately. The workflow of the maintenance division/section includes four major jobs.

Procedures in Maintenance Subsystem

Shelf Rectification : It is to shelve misplaced documents in proper locations.

Bind : It is to preserve library resources for posterior and present use.

Replace : It is to replace a lost document by the library.

Discard/Withdrawn : It is to weed out out-dated and torn & soiled documents from the library for making enough space for usable stock.

The integrated library automation environment requires information on lost, damaged, missing and withdrawn documents as well as documents sent for binding. These datasets are to be entered to generate and display appropriate messages for the library users and staff against specific tasks in different modules. This is also required to generate reports on lost books, missing books, books sent for binding etc. for the library administration.

2.2.2 Analysis of Tasks

The subsystems and the procedures for their managing subsystems require a set of tasks to be performed. In an automated library system a task is the collective functions of the elements for the accomplishment of the module at the next higher level. Tasks within each activity, just as the activities themselves, may not all be necessary to each procedure.

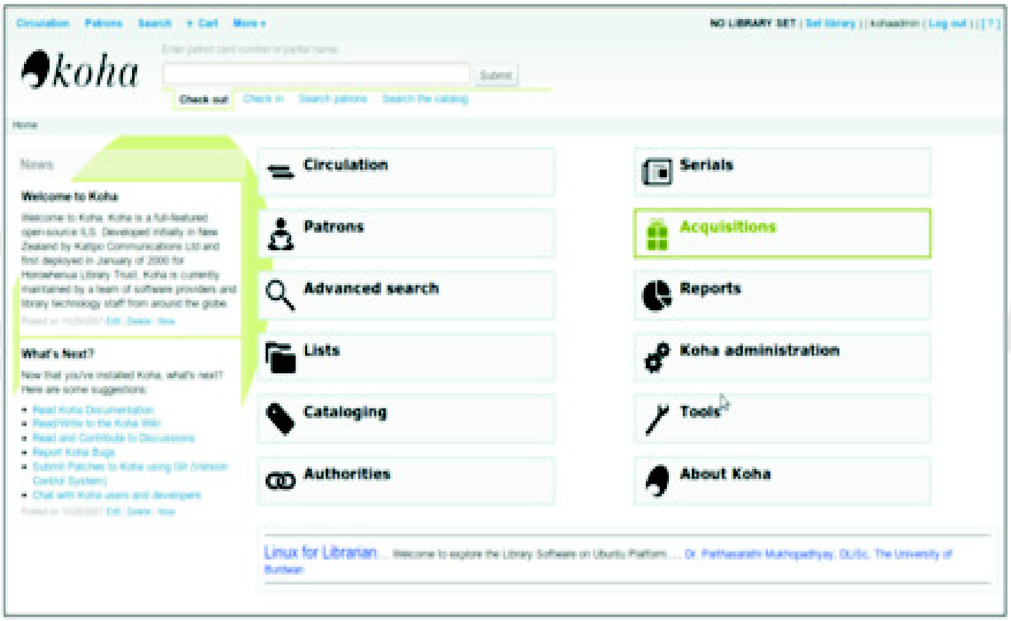
Table 2.2: Task analysis in workflow

SYSTEM	**LIBRARY SYSTEM**				
SUBSYSTEM	**ACQUISITION SUBSYSTEM**				
PROCEDURE	**ORDER**				
ACTIVITIES	**INITIATE**	**AUTHORISE**	**ACTIVATE**	**RECORD**	**CANCEL**
What information?	Author, Title, Sub-title, Edition, Place, Publishers, Date, ISBN etc.	Signature of Approval	Library/Branch Library, Date of Order, Order number, Name of Vendor and Bibliographical details etc.	Administra-tive data, Bibliographic data	Order Number, and Date Vendor, Book details
Where from?	Bibliographies, Index, Requisition, Suggestions	Competent Authority	Book Selection Tools, MIS	Order form/ Order letter	Order File/ Computer Database
When?	After Select Procedure	Before Activation	After Authorisation	After Activation	After Activation
Who?	Library Asst./ Technical Asst.	Librarian/ Section-In-Charge	Library Asst./ Technical Asst	Library Asst./ Library clerk	Library Asst.
How?	Receiving copy of Bibliographies, Suggestion slip	Enter Signature	Enter data/ information on Order form/ Computer Database and Generate Order	Filing the Copy of Order form/ Saving in Computer	Deletion from Database/ Removal from File

The analysis of tasks to perform activities within procedures may be done through a set of five primary questions: What information is needed for the activity? Where is the information obtained? When is it required? Who requires it? How is it used? These five questions should be asked to carry out possible activities under each procedure (see Table 2.2). It provides depth to the framework provided by the procedural model. An example of this approach may be shown (in Table 2.2) in the context of five possible activities of book order procedure in acquisition subsystem.

2.2.3 Automation of Workflow

The subsystems and workflows as discussed in previous two sections are completely amenable to computerisation. An Integrated Library System (ILS) manages all the subsystems of a library such as acquisitions, cataloguing, circulation, serials control and administration. These jobs are done by library professionals through librarian/administrator interface of ILS with proper authentication (login and password). The Fig. 2.1 shows modules in Koha (an open source ILS) for managing acquisition, cataloguing (bibliographic data and authority data), circulation (including member/patron management), serials control, system administration (including report generation, export/import, backup/restoration etc.).



Welcome to Koha

Welcome to Koha. Koha is a full-featured open-source ILS. Developed initially in New Zealand by Katipo Communications Ltd and first deployed in January of 2000 for Horowhenua Library Trust, Koha is currently maintained by a team of software providers and library technology staff from around the globe.

Posted on [illegible] Edit | Delete | New

What's Next?

Now that you've installed Koha, what's next? Here are some suggestions:

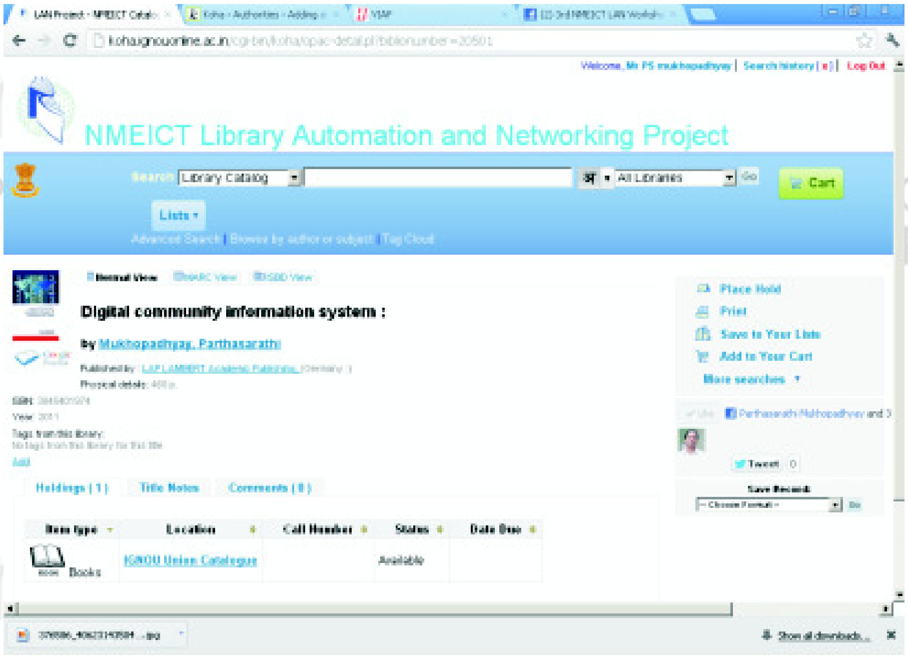
- Read Koha Documentation
- Read/Write to the Koha Wiki
- Read and Contribute to Discussions
- Report Koha Bugs
- Submit Patches to Koha using Git (Version Control System)
- Chat with Koha users and developers

Posted on [illegible] Edit | Delete | New

Linux for Librarian ... Welcome to explore the Library Software on Ubuntu Platform ... Dr. Parthasarathi Mukhopadhyay, DLISc, The University of Burdwan

Fig. 2.1: Modules for managing subsystems and workflow in Koha

The ILS also provides a discovery interface (commonly known as the Online Public Access Catalog or “OPAC”) that enables patrons to search for resources. OPAC includes simple and advanced search interfaces with supports for member login (to check reading history, borrowed books, fines, suggestions etc.). Most of the ILSs now provide Web-OPAC (accessible through web browser) and these are now compatible with social networking tools (such as facebook, twitter etc.) and information mashup to integrate external datasets (like book cover image, book reviews etc.) with local library materials. (see Fig. 2.2).



Welcome, Mr PS mukhopadhyay | Search history [x] | Log Out

NMEICT Library Automation and Networking Project

Search Library Catalog ▾ अ ▾ All Libraries ▾ Go Cart

Lists ▾

Advanced Search | Browse by author or subject | Tag Cloud

Normal View MARC View ISBD View

Digital community information system :

by Mukhopadhyay, Parthasarathi

Published by : LAP LAMBERT Academic Publishing, (Germany :)

Physical details: 400 p.

ISBN: [illegible]

Year: 2011

Tags from this library:
No tags from this library for this title.
Add

Holdings (1) Title Notes Comments (0)

Item type	Location	Call Number	Status	Date Due
Books	IGNOU Union Catalogue		Available	

Place Hold
Print
Save to Your Lists
Add to Your Cart
More searches ▾

Like Parthasarathi Mukhopadhyay and 3

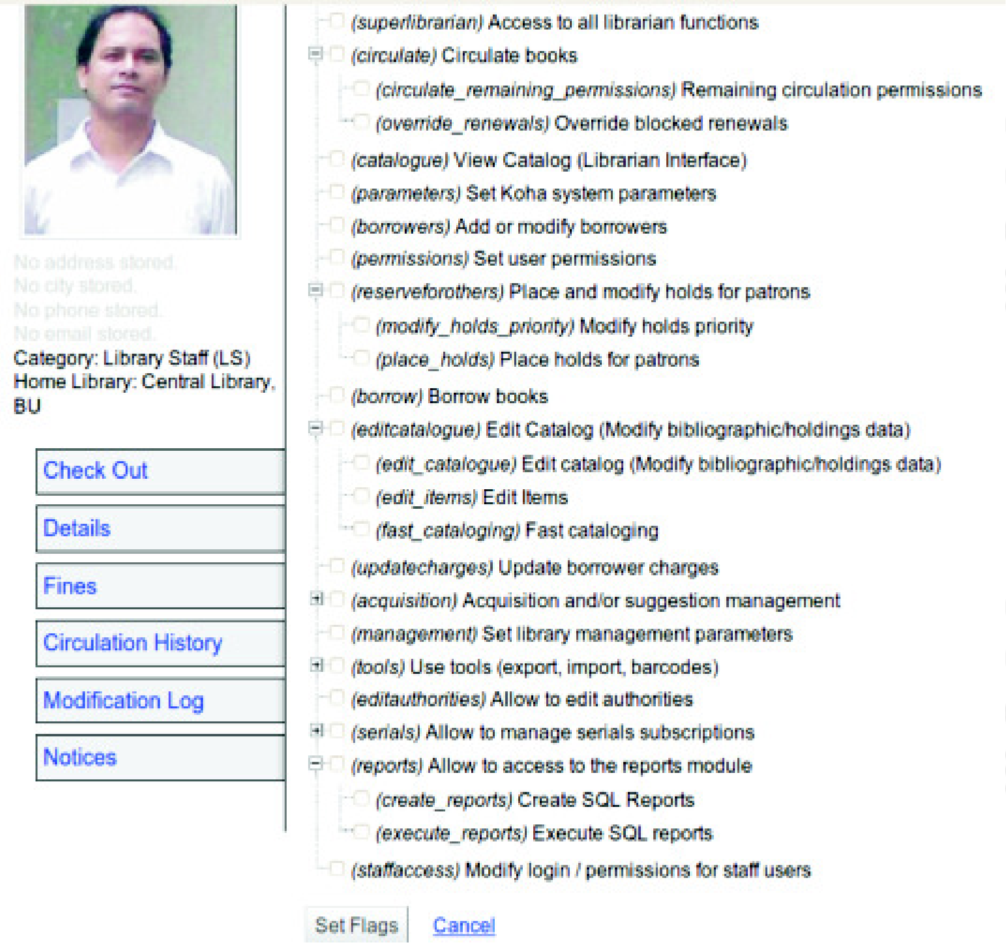
Tweet 0

Save Record:
-- Choose Format -- ▾ Go

Show all downloads...

Fig. 2.2: End user interface in Koha with social networking tools

In ILS, system administrator can define privileges (known as privilege control) for each staff of the library. Privilege control ensures responsibility for each staff and also secures integrity of ILS.



No address stored.
No city stored.
No phone stored.
No email stored.
Category: Library Staff (LS)
Home Library: Central Library, BU

- □ *(superlibrarian)* Access to all librarian functions
- □ *(circulate)* Circulate books
  - □ *(circulate_remaining_permissions)* Remaining circulation permissions
  - □ *(override_renewals)* Override blocked renewals
- □ *(catalogue)* View Catalog (Librarian Interface)
- □ *(parameters)* Set Koha system parameters
- □ *(borrowers)* Add or modify borrowers
- □ *(permissions)* Set user permissions
- □ *(reserveforothers)* Place and modify holds for patrons
  - □ *(modify_holds_priority)* Modify holds priority
  - □ *(place_holds)* Place holds for patrons
- □ *(borrow)* Borrow books
- □ *(editcatalogue)* Edit Catalog (Modify bibliographic/holdings data)
  - □ *(edit_catalogue)* Edit catalog (Modify bibliographic/holdings data)
  - □ *(edit_items)* Edit Items
  - □ *(fast_cataloging)* Fast cataloging
- □ *(updatecharges)* Update borrower charges
- □ *(acquisition)* Acquisition and/or suggestion management
- □ *(management)* Set library management parameters
- □ *(tools)* Use tools (export, import, barcodes)
- □ *(editauthorities)* Allow to edit authorities
- □ *(serials)* Allow to manage serials subscriptions
- □ *(reports)* Allow to access to the reports module
  - □ *(create_reports)* Create SQL Reports
  - □ *(execute_reports)* Execute SQL reports
- □ *(staffaccess)* Modify login / permissions for staff users

Fig. 2.3: Privilege control in Koha

For example only designated circulation staff of the library (with authentication can enter into circulation module for issue, return and collecting overdue charges; similarly one staff (with login and password known only to him/her) can perform acquisition activities. Moreover (see privilege control granularity in Koha in Fig. 2.3) super-user of the ILS can control/enter in every modules. Only chief librarian should know the login/password of super-librarian. The integrated functions of ILS ensure streamlining of library operations, and the data ILS manages gives rich information through information Mashup (the concept discussed in unit 1 of this block).

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

1) Give an overview of library workflow.

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2) What is serials control? Enumerate activities in serials control.

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3) What is system analysis? Discuss its role in library automation.

....

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....

2.3 ACQUISITION SUBSYSTEM IN ILS

Acquisition module of an ILS handle administrative, financial and bibliographical data related to the documents to be procured in libraries. An integrated library management system will transfer necessary bibliographical data (such as author, title, ISBN, edition) of newly procured documents to the cataloguing module of the package as and when those are marked received in the acquisition module. Integrated library system thereby avoids unnecessary duplication of data or data redundancy and achieves economy in terms of time, manpower and money. This section discusses acquisition procedures under three heads – functional requirements, acquisition workflow and advantages of automated acquisition subsystem.

2.3.1 Functional Requirements for Acquisition in ILS

You already know that the ordering and acquisition process involves some basic routine clerical operations (as discussed in Unit 1 of this block), which are applicable to all categories of library. As a result, the procedures related to acquisition subsystem have benefited from computerisation. Generally, acquisition subsystem concentrates on monographs and other documents (available in many formats) excluding periodical publications. The basic activities of automated acquisition subsystem are: 1) To receive records of items to be acquired; 2) To check whether items requested are already in the library or on order; 3) To print orders or dispatch order electronically to supplier/publishers; 4) To check when orders are overdue; 5) To follow up overdue order; 6) To maintain a file of records of items on order; 7) To note the arrival of ordered items; 8) To process for payment; 9) To maintain book fund statistics and accounts; 10) To generate printed and electronic listing of various reports; 11) To control currency conversions; and 12) To maintain vendor performance reports and statistics. Apart from these basic activities, acquisition module of ILS should also provide support to – 1) Accommodate a variety of materials, including but not limited to – monographs, monograph in series, annual and cumulative indexes, loose leaf materials, supplements, reports, musical scores; 2) Accommodate and identify items in a variety of formats, including but not limited to – print, microform, film, videotape, audio cassette, CDROM, magnetic tape etc.; 3) Record, store and display bibliographic information, acquisition type (order, gift, approval etc.), status (reported, received etc.), library/branch/copy/fund information, invoice information, vendor information, accounting information, requester information etc.; 4) Extend facilities for unlimited number of funds/ budget head, vendors, orders, claims and transactions; 5) Accommodate different types of order – regular order, membership, approval, blanket order, deposit account etc.; 6) Global standards related to document acquisition such as EDIFACT; and 7) Generate reports and statistics related to acquisition activities.

The next sections discuss three groups of activities related to acquisition. These are – pre-acquisition work, acquisition work and generation of outputs.

2.3.2 Workflow of Automated Acquisition

The acquisition workflow may be studied under two heads – pre-acquisition work and acquisition activities. Acquisition module of an ILS requires some essential works that need to be done before proceeding with actual acquisition work. These are termed as pre-acquisition work and may be identified as:

- **Pre-acquisition Works**

The general activities of this group are:

A.1) **Creation of master file for supplier**

The acquisition module must incorporate a vendor/supplier file supporting an unlimited number of vendor records including at least the following information — vendor name, address, code, phone, fax, e-mail ID, contact person, vendor discount etc.

A.2) Currency conversion

This facility is required to assist in procuring foreign documents priced in various currencies of the world (e.g. US Dollar, Euro, UK Pound etc.). The conversion of foreign currencies into Indian rupees is necessary for fund accounting and payment on the basis of the current exchange rates.

A.3) Budget process control

One of the major functions of library ordering and acquisitions subsystem is to record and to control expenditure from the library's accounts. Funds are committed for spending when orders are placed and are actually spent when the items are received in the library. Fund accounting helps to keep track of library's annual book budget and its allocation. The fund accounting aspect of a typical acquisition module in a library automation package includes four basic steps:

- **Creation of budget heads**

In this step various budget heads are created as per the prevailing practice in the library (e.g. book procurement fund, serial subscription fund, electronic resource procurement fund etc.). Each budget head is described in details and accessed through a code for easy recall as and when required.

- **Main budget allocation**

This is related to allocate the amount to the main budget along with other necessary information such as financial period, budget head, opening balance and total amount allocated or sanctioned amount. This minimum dataset is to be entered before activation of the budget process in the acquisition module.

- **Budget allocation in different heads**

This step is for receiving the amount in different budget heads.

- **Budget division**

Sometimes it is necessary to divide a budget head into several sub-heads (e.g. a book procurement head may further be subdivided into reference books and text books). This step allows a user to divide the budget into sub-heads or even divide the budget sub-heads further.

A.4) Creation of letter formats

An automated acquisition sub system should generate and print various letter formats such as approval letter, purchase order, cancellation of order, reminder letter, intimation letter, payment letter etc. In this step templates of respective letters are created and maintained by the user.

A.5) Creation of member database

This step is to create and maintain a member system. It is required to link and integrate suggestions given by the users (for procuring various materials) with the member database. Creation of member database is based on some master entries. These are – Category and associated privileges, Name of the affiliated institute, Departments/Branches/Divisions/Sections under the institute, Name of member, Member code etc. New members can be added after these steps. Member codes are either generated automatically or may be entered manually as per the practice of the library.

- **Acquisition Works**

Actual acquisition work starts after completion of pre-acquisition works. The flow of acquisition works for document procurement in computerised libraries irrespective of type or size may be divided into four logically related groups – 1) Document related work; 2) Order processing; 3) Accessioning; and 4) Payment.

Group I tasks

Acquisition work starts with collection of information related to documents to be procured. Library staff initiates acquisition with entering bibliographical information and information about requesters from the suggestion slips and books submitted by the suppliers on approval. Bibliographical data given by the requesters in suggestion slips require to be verified by consulting book selection tools. The online databases of virtual bookstores (like Amazon or BookFinder) may also be utilised for checking bibliographical information of recently published documents. Bibliographical details of documents received by libraries in ex-gratis are also entered into the database. A library normally receives a large number of suggestions and documents for ordering. Library staff shortlist these requests depending on need, availability of fund etc. by clicking the appropriate option(s) available in the package. Finally a report is generated for all the short-listed suggestions and documents indicating number of copies required, budget code, budget head and unit price of the items requested. The library committee approves the list officially and on the basis of the final approval list library staff either select or reject the short listed titles. Books on direct approval and gratis items do not have to go through approval process from library committee or any such authoritative body.

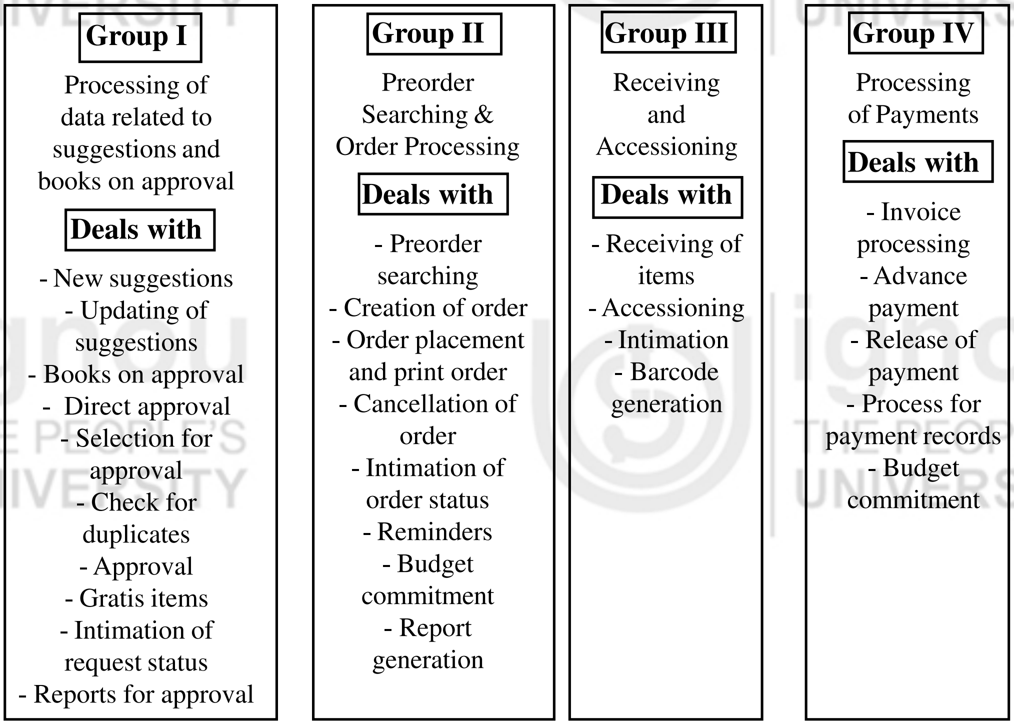

Fig. 2.4: Workflow of acquisition work

Group II tasks

The first step of this group is to select listed vendors (available from master files) for placing orders of approved documents. Order letters are then printed as per the format created in the pre-acquisition stage indicating name of supplier with address, reference number, terms and conditions and expected date of delivery etc. This group also includes the tasks of reordering, reminder generation (for a particular order or to a particular supplier/publisher) and report generation (for ordered items, overdue orders, budget commitment etc.).

Group III tasks

This group includes the works of receiving and accessioning of ordered documents. In case of barcode based circulation system barcode labels for accessioned items are also generated in this sub-module of the package. The requester or department may be informed about the arrival of requested documents in the library through the generation of intimation letter.

Group IV tasks

The work of this group starts with the processing of invoices submitted by the suppliers along with the documents by entering necessary elements into the database. Release of payment is the next step in which letters/reports containing all the necessary administrative and financial details are generated against supplier or order number or invoice number for requesting appropriate authority (generally Finance Section) to release payment to the supplier. After release of payment, the financial details of payment are entered and stored into the database.

2.3.3 Products and Advantages

Computerised acquisition subsystem includes three basic operations – input, processing and output. Data entering and processing tasks in various pre-acquisition and acquisition works are primarily act as input data. The datasets are processed and integrated with other modules of the ILS and finally generated various outputs in the form of list, reports, letters and statistics. Table 3 in the next page lists all the possible reports from acquisition module of ILS. The advantages of computerised acquisition subsystems in an integrated automated environment are manifolds. Such systems can perform following activities:

- Generate financial and statistical reports in the desired format automatically to help planning and management of libraries;
- Ensure quicker and cheaper data processing;
- Contribute in the development of integrated library system by integrating with document processing module (to transfer bibliographic data) and member module (for helping online requisitions/suggestions from members);
- Reduce the workload of processing section by transferring manifestation and item related information related with documents received (modern ILS supports MARC 21 based item processing framework mainly through 9xx series on te basis of FRBR model);
- Minimise routine clerical operations and related paper works;
- Lead towards better management and more productive use of library staff;
- Support real time fund accounting and help to introduce new user services;

- Produce number of reports, letters, statistics and list to support MIS activities of libraries;
- Interact with other library systems/networks to download bibliographical data of items on order on the basis of global standards related to electronic fund transfer; and
- Communicate different outputs of acquisition works electronically to members, suppliers, publishers etc.

Table 2.3: Reports from Computerised acquisition subsystem

• List/Report of item(s) requested • List/Report of item(s) from supplier/ publisher • Item(s) selected for approval • Item(s) approved by the authority/library committee • Item(s) rejected in the approval process • List of gratis item(s) received by library • Report on request status • Printout or softcopy of letters for approval • Printout or softcopy of order letters & query letters • Printout or softcopy of reminder letters • Printout or softcopy order cancellation letters • Printout or softcopy of reordering • Letters for adjustment of advance payment • Letters to bank for foreign exchange rate • Report on order status • List/Reports of item(s) selected for order	• List/Report of overdue item • List/Report of item(s) actually ordered • Reports of budget commitment • List/Reports of item ordered against advance payment • List/Reports of item(s) received against orders • Letters of intimation (on arrival of documents) • Printout of accession register • Printout of barcode labels • List of supplier/publishers • List of currency and exchange rates • Budget with commitments • Report of detailed annual budget of library • Report on amount received in different budget heads • Report/statistics of vender performance • List of recent additions • Generation of book cards (in case of integrated ordering and cataloguing system)

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

4) What do you mean by Pre-acquisition work?

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5) Point out the major advantages of automated acquisition subsystem.

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2.4 DOCUMENT PROCESSING SUBSYSTEM IN ILS

In automated document processing environment, resource description or cataloguing is possibly the most important task of library automation work. It requires standardisation and should be supported by carefully crafted decision table(s). The cataloguing module of ILS gives us freedom to choose MARC standards (UNIMARC and MARC 21) or Non-MARC standards (like Common Communication Format or your own standard). However, MARC 21 bibliographic format is now considered as the global de facto standard. MARC 21 family of standards (a family of five coordinated standards such as bibliographic standard, authority standard, community information standard holding format and classification format) are now selected as content designator in most of the ILSs. There are two reasons for it. First, MARC 21 standards are updated continuously, available through Web, and emerging as open standards. Secondly, these are now becoming almost the de facto global standards in the domain of library automation as these are adopted by the national libraries in different parts of the world. Cataloguing module of an ILS should also be supported by an array of internationally agreed upon standards and facilities like – FRBR, FRAD, pickup lists, authorised value lists, standard lists, export-import through ISO-2709 or MARC-XML etc. This section discusses automated document processing subsystem under three major heads – 1) Functional requirements, 2) Workflow, and 3) Advantages and products.

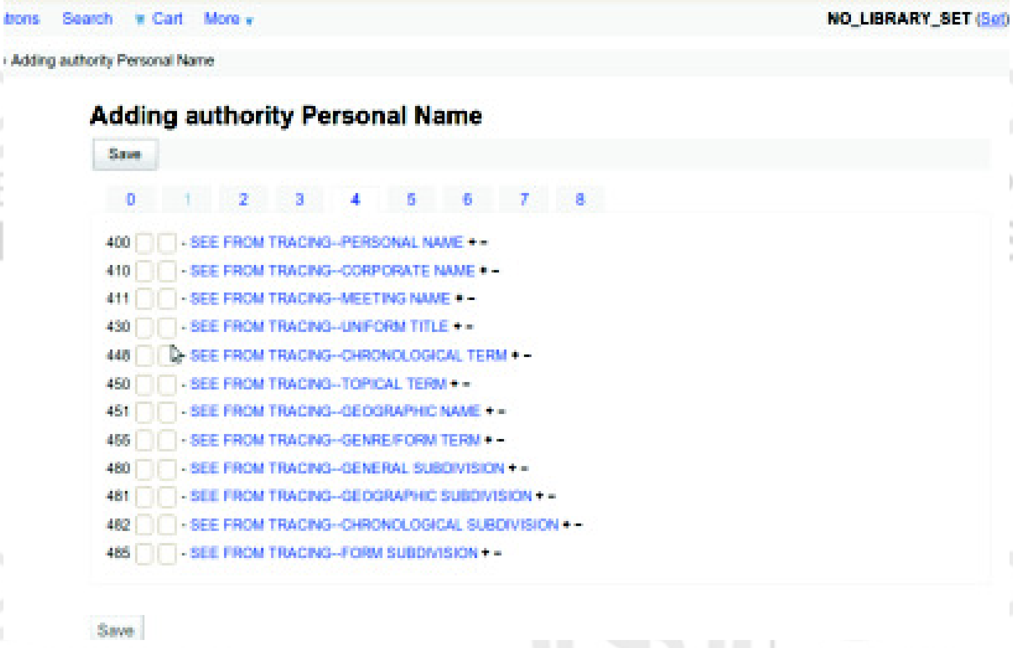
2.4.1 Functional Requirements for Document Processing in ILS

The functional requirements of cataloguing module of an ILS (as suggested by Mukhopadhyay, 2006) include areas like authority data, bibliographical data, distributed cataloguing, OPAC, reports, backup and restoration, export and import, and multilingual data process and retrieval.

Authority Control

The ILS must support following facilities for mangaing authority data:

- Support for MARC authority format for personal, corporate and topical name headings in a name authority file; title, uniform title and series entries in a title authority file and subject headings in a subject authority file;
- Provision for generation of SEE, SEE ALSO references and NT-BT-RT relationships network from authority records and link these references to matching access points in OPAC;
- Must allow any bibliographic field to be authority controlled (particularly 1xx, 6xx and 7xx groups in MARC 21 bibliographic format) and should include facilities to search, retrieve, and display print and global editing of authority records by authorised operators;
- Must include provision for multiple thesauri with the ability to produce a list of all citations with authority file violations; and
- Provision to link local catalogue data with global linked open authority data like VIAF (a service merging authority data from 25 national libraries available from viaf.org).



Adding authority Personal Name

```
400 □ □ - SEE FROM TRACING--PERSONAL NAME + -
410 □ □ - SEE FROM TRACING--CORPORATE NAME + -
411 □ □ - SEE FROM TRACING--MEETING NAME + -
430 □ □ - SEE FROM TRACING--UNIFORM TITLE + -
448 □ □ - SEE FROM TRACING--CHRONOLOGICAL TERM + -
450 □ □ - SEE FROM TRACING--TOPICAL TERM + -
451 □ □ - SEE FROM TRACING--GEOGRAPHIC NAME + -
455 □ □ - SEE FROM TRACING--GENRE/FORM TERM + -
480 □ □ - SEE FROM TRACING--GENERAL SUBDIVISION + -
481 □ □ - SEE FROM TRACING--GEOGRAPHIC SUBDIVISION + -
482 □ □ - SEE FROM TRACING--CHRONOLOGICAL SUBDIVISION + -
485 □ □ - SEE FROM TRACING--FORM SUBDIVISION + -
```

Fig. 2.5: MARC 21 authority data entry framework (name authority) in Koha ILS

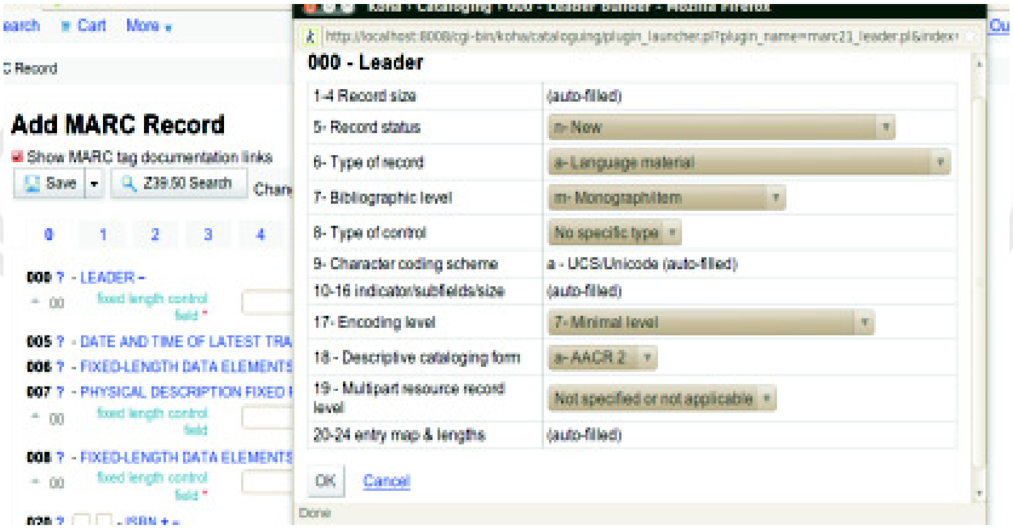
Bibliographic Control and Interoperability

The bibliographic record management capabilities of an ILS should extend support for –

- MARC 21 bibliographic and authority framework for processing bibliographic data including multilingual data processing support (Unicode character set processing ability);
- MARC record loader that can accept records input from various sources and from various media like tape diskette or over network;
- Global editing utility that find and replace data within specified fields;
- Data format validation during input of bibliographic data;
- MARC 21 format for holding and display of holding on the basis of ANSI Z39.44 serials holdings display format;
- Import of bibliographic data through Z39.50 complaint distributed cataloguing interface; and
- Interoperability and crosswalk through incorporation of XML, RDF and metadata schemas (e.g. Dublin Core Metadata);

Some tags and subfields of bibliographic framework(s) require support for achieving standardisation in data entry activities. For example, the Leader fields (24 character fixed length field) in MARC 21 is necessary for different document types and the process of entering data for different character positions is quite complex. For example, the following tags and subfields of MARC 21 bibliographic format require support of pickup lists, code lists, standard lists etc. during data entry activities:

Field	Description	Type of Support
Leader	24 characters fixed-length field	Pickup list for character positions
005	Date and time of latest transaction	Automated entry of date and time from system
006	Books – (00-17) – Fixed-length field	Pickup list for character positions
007	Text - (00-01)	Pickup list for character positions
008	Fixed-length data elements	Pickup list for character positions
040	Cataloguing Source	Pickup of library code (as per MARC)
041	Language Code	Code list support (as per MARC)


earch
Cart
More
Record
Add MARC Record
Show MARC tag documentation links
Save
Z39.50 Search
Chan
0
1
2
3
4
000 ? - LEADER -
00
fixed length control field *
005 ? - DATE AND TIME OF LATEST TRA
006 ? - FIXED-LENGTH DATA ELEMENTS
007 ? - PHYSICAL DESCRIPTION FIXED
00
fixed length control field
008 ? - FIXED-LENGTH DATA ELEMENTS
00
fixed length control field *
020 ? - ISBN + -
OK
Cancel
Done

http://localhost:8008/cgi-bin/koha/cataloguing/plugin_launcher.pl?plugin_name=marc21_leader.pl&index

000 - Leader

1-4 Record size	(auto-filled)
5- Record status	n- New
6- Type of record	a- Language material
7- Bibliographic level	m- Monograph/item
8- Type of control	No specific type
9- Character coding scheme	a - UCS/Unicode (auto-filled)
10-16 indicator/subfields/size	(auto-filled)
17- Encoding level	7- Minimal level
18 - Descriptive cataloging form	a- AACR 2
19 - Multipart resource record level	Not specified or not applicable
20-24 entry map & lengths	(auto-filled)

Fig. 2.6: Support to manage Leader field (24 character positions) in Koha ILS

Online Public Access Catalogue (OPAC)

- OPAC must be fully integrated with other modules and accessible through web-based client;
- OPAC should provide browse indexes for author, title, and series and browse index combining all four indexes;
- Should support searching different forms of authorities;
- It should allow combined, specific and field level searching for all formats along with phrase searching, nested searching and truncated searching;
- It must enable searching by using Boolean operators (OR, XOR, NOT, AND), positional operators (SAME, WITH, NEAR, ADJ) and relational operators ('greater than', 'less than', 'equal to', etc.) within and across all fields including provision for Fussy searching;
- It should provide facility to see processing status (fully catalogued, in process, lost, withdrawn etc.) and circulation status (in transit, reserve, recalled, on-hold etc.);
- OPAC should support full, brief, standard and customised display of records including relevancy ranking of search results;

- OPAC should also support bulletin board, information desk and gateway services (to access external databases) along with patron self-service options (e.g. holds, renewals etc.); and
- OPAC must track users' preference and interests, organised into a list of favourities and support interactive, participative and collaborative platform through web 2.0 tools like RSS, social networking tools, user tagging, document rating etc.

Distributed cataloguing

- Must be Z39.50 complaint cataloguing system [ANSI/NISO Z39.50 (1995) or ISO 239.50 (1998)];
- Should enable to capture bibliographic and authority records from any Z39.50 server through Z39.50 client; and
- Should allow local manipulation (change of call number etc) of captured data.

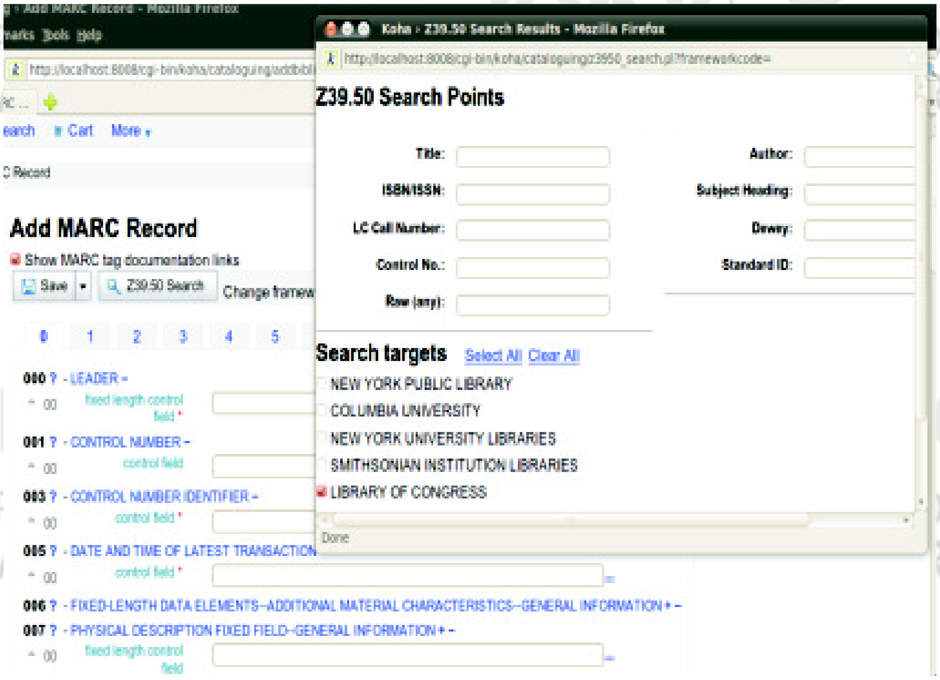

Add MARC Record - Mozilla Firefox
Koha › Z39.50 Search Results - Mozilla Firefox
http://localhost:8008/cgi-bin/koha/cataloguing/z3950_search.pl?frameworkcode=
Z39.50 Search Points
Title:
ISBN/ISSN:
LC Call Number:
Control No.:
Raw (any):
Author:
Subject Heading:
Dewey:
Standard ID:
Search targets
Select All
Clear All
NEW YORK PUBLIC LIBRARY
COLUMBIA UNIVERSITY
NEW YORK UNIVERSITY LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
☑ LIBRARY OF CONGRESS
Done
Add MARC Record
Show MARC tag documentation links
Save
Z39.50 Search
Change framew
0 1 2 3 4 5
000 ? - LEADER -
001 ? - CONTROL NUMBER -
003 ? - CONTROL NUMBER IDENTIFIER -
005 ? - DATE AND TIME OF LATEST TRANSACTION
006 ? - FIXED-LENGTH DATA ELEMENTS--ADDITIONAL MATERIAL CHARACTERISTICS--GENERAL INFORMATION + -
007 ? - PHYSICAL DESCRIPTION FIXED FIELD--GENERAL INFORMATION + -
fixed length control field
control field

Fig. 2.7: Z39.50 client to support distributed cataloguing in Koha ILS

Reports and backup requirements

- Must produce a count of all records added, edited by a specific operator or over a specified time period;
- Must generate lists, statistics and counts of items added or tabulated by call number, item categories, item location, holding library etc.;
- Must produce a list of all citations with authority file violations; and
- Must support backup of all cataloguing records in suitable media (magnetic, optical etc.) and easy recovery of records at the time of need.

2.4.2 Workflow of Automated Document Processing

The workflow of document processing subsystem involves two major jobs – bibliographic data management and authority data management. Bibliographic data are managed in two basic modes – 1) cataloguing data entry for newly acquired library materials processed in acquisition module; and 2) cataloguing data entry for existing library materials not processed through acquisition module (also known as Retrospective Conversion or ReCon). The works of cataloguing module of an ILS are –

- Authority data management
  1) Authority data entry
     - Name authority
     - Subject authority
     - Title authority
  2) Authority data linking
- Bibliographic data management
  - For newly acquired document
  - For existing old stock

Bibliographic Data Entry for Cataloguing

This facility of the catalogue module of automation packages is utilised for updating and standardisation of bibliographical data elements of newly procured documents and entering bibliographical data of existing old stock of the library. Easy and structured data entry form design on the basis of standard content designator scheme is important for local creation of records. An integrated automation package use the same record for cataloguing function as is used in the acquisition module. In the catalogue module the record is standardised through entering additional data elements and rendering of access points with the help of authority file. The transformation of bibliographical data elements of existing stock of any library into machine-readable form is called Retrospective Conversion or simply RECON. The work of RECON starts with recording of bibliographical data elements on a worksheet. The worksheet is designed as per the internal data format of the automation package. These internal bibliographic data formats are based on internationally adopted standard content designator schemes such as MARC 21, UNIMARC or CCF. Finally bibliographical data of each document as recorded on the worksheet is entered into the catalogue database. The data entry work may be done by the library staff or the job may be dome through outsourcing. In some cases library may procure validated MARC 21 bibliographic data from the following sources –

1) **Existing library catalogue in machine readable from**

   Bibliographic data in standard formats (MARC, UNIMARC, USMARC, CCF, MARC 21) are available in many libraries for merging into the catalogue database of newly installed LMS through import (ISO-2709 based exchange of bibliographic data).

2) **Union catalogue**

   Library networks at the global level (like OCLC, RLN) and national level (like INFLIBNET and DELNET in India) provides union catalogue of member libraries in machine readable form. Union files of the stock of several libraries, or another shared database may be imported, converted into local standard format and finally merged into the catalogue database.

3) **Commercially available files of MARC records**

In this process records from external databases may be added from tape, or by downloading directly from the files through network. A further option is to acquire records on CDROM or DVDROM and to download records from optical media. For example Harvard University, US recently uploaded all bibliographic records in MARC 21 format (2 million book records) for other libraries.

4) **Z39.50 server**

Computerised cataloguing provides a unique advantage of loading and merging of bibliographic and authority records from external databases. There are thousands of Z39.50 servers from where selective downloading of validated bibliographic data may be done at the local level (see Fig. 7). This feature of an automated system leads to a reduction in cataloguing effort and a consequent saving in the unit cost of cataloguing. This mode of shared cataloguing is popularly termed as copy cataloguing and implemented in ILSs through Z39.50 standard developed by ANSI/NISO.

Authority Data Entry for Cataloguing

A library catalogue supports two basic functions – finding function and collocation function. Bibliographic datasets support finding function and authority datasets support collocation function. Therefore, authority file is essential to control from of index terms or headings, such as author headings, or subject index terms for better retrieval efficiency. Authority data management has two basic routes – internal dataset creation and external dataset application. Records in this file may be created locally by using a standard authority data framework standard like MARC 21 authority data format (see Fig. 2.5) or drawn from externally available files such as the name and subject authority files of the Library of Congress or other agencies. Library automation packages provide facility to create and maintain authority file in the catalogue module. This file is acting as a master database, where entry is to be made once. This gets reflected in various modules of the package. The master file containing authority entries can be consulted

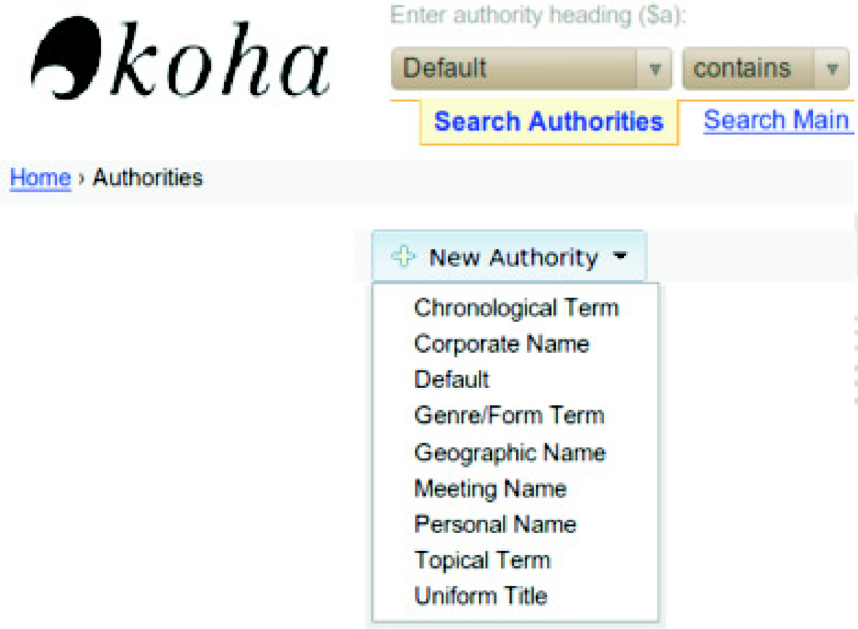


Fig. 2.8: Authority data types in Koha ILS

during cataloguing, possibly by display in a separate window and new headings are immediately added to the authority file with an opportunity to review or authorised locally or remotely. For example, Fig. 2.8 shows the authority data entry options in Koha ILS. Selection of authority data type will display corresponding authority data entry framework (as Fig. 2.5 shows name authority data entry format) for processing work.

Alternatively libraries may take advantages of cooperative authority datasets like LoC authority data, NACO, SACO and VIAF –

Name Authority Cooperative Program (NACO)

It is one of the components of the Program for Cooperative Cataloging (PCC) that was initiated in 1995 by the Cooperative Cataloging Council (CCC) in the USA (PCC, 1998). The NACO program enables participants to add name authority records to the national name authority file, which is hosted at the Library of Congress and downloading of authority data from the server.

Subject Authority Cooperative (SACO)

The SACO program allows cataloguers to propose new and updated authority records for inclusion in Library of Congress Subject Headings (LCSH) and the LC/SACO Authority File. SACO is also working under Program for Cooperative Cataloging (PCC).

LoC Authority Data Service

Library of Congress Authority datasets allows to browse and view authority headings for subject, name, title and name/title combinations for bibliographic and other materials available in LoC. It also facilitates downloading authority records in USMARC/MARC 21 format for use in a local library system. This service is offered by LoC free of charge.

Virtual International Authority File (VIAF)

VIAF is a new, international service designed to provide convenient access to the world’s major name authority files from 25 national libraries under the leadership of OCLC (limited in the initial stages of the service to names for persons). Its creators envision the VIAF as a Linked Open Data (LOD) for linking in local services like ILSs. An ILS can link VIAF automatically from authority data entry interface through application program interface.

2.4.3 Products and Advantages

OPAC is possibly the most visible product of document processing subsystem of an ILS. But it is not the only one. This subsystem produces different other forms of library catalogue like Card catalogue (main entry and added entries), Printed book catalogue, Microform and Computer output on microform. ILS supports the generation of various reports, lists and labels that are required for the management of catalogue section such as Reports with a count of all records added, modified or edited by a specific operator or over a specific period of time; Reports that produce statistical account of items added and tabulated by call number, item categories, item location etc.; Lists of items catalogued by class number, subject heading, collection type, language etc.; Spine labels, shelf catalogue, book cards etc.. This module of ILS also generates information products that form the basis of a number of user services such as bibliographic service, current awareness service etc. These are typically – List of books received in the library (during a particular period, on a particular subject, by a particular author or by a particular author on a particular subject in a particular period) and Bibliographies of documents received by the library in standard format or as per the format specified by users. Modern OPACs are changing from monologue to dialogue based service by the applications of Web 2.0 tools, federated search mechanism and discovery services (see section 1.7 of Unit 1 in this block).

The application of advance level ICT in the management of library processes leads to a significant change in the nature and role of catalogue records. The impact of these changes has contributed towards standardisation of entry format, resource sharing and efficient access to documents and their contents. For example Web-OPAC overcomes two fundamental barriers of access to information – time and space (anyone can search from anywhere at any time). In an integrated set up circulation module and acquisition control programs utilise cataloguing records. Similarly catalogue module uses bibliographical data elements of records created in acquisition procedure and also utilises transaction records from circulation control to notify users about the availability of a selected document. The other advantages of automated document processing (as identified by Mukhopadhyay, 2006) are –

- Computerised cataloguing ensures greater standardisation in catalogue records;
- It reduces routine clerical operations required for maintenance of catalogue;
- It supports interchange of catalogue records and thereby ensures reduction in unit cost of cataloguing;
- It supports seamless access to not only library resources but also web resources, OPACs of other libraries, online databases and a variety of information services including subject gateways through federated search mechanism and thereby ensues a single-window access interface for users;
- It provides opportunities to take output in a number of forms and formats;
- It enables users to retrieve relevant records through the application of variety of search techniques and search operators and to display the retrieved records in desired formats; and
- It helps library staff to generate variety of information services.

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

6) What is distributed cataloguing? How can it help libraries?

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7) Discuss the MARC 21 family of standards.

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2.5 SERIALS CONTROL SUBSYSTEM IN ILS

International Serials Data System (ISDS) defined *serial* as a publication issued in successive parts and intended to be continued indefinitely. Serials include periodicals, newspapers, annuals, proceedings, transactions etc. and are differentiated from monographs by their ongoing or continuing nature. Serials management subsystem of an ILS has to deal with the features unique in serials control such as – Periodicals are procured through various subscription modes and by gift or exchange; Successive issues are received at regular or irregular intervals and it is necessary to ensure that successive issues arrive when they have been published; Subscriptions to periodicals must be renewed recurrently; Catalogue data that describe serials must be extensive and should be supported by formats exclusively designed for serials; Serials change their titles, are published under variant titles and may change their frequency of publication, therefore, references must be inserted to link associated periodical titles; Precise control over the binding of successive issues is very important (alternatively called as backvolume management); Indexes, special issues and supplements must be controlled for effective retrieval; and Article-indexing is an added advantage for serials control module.

2.5.1 Functional Requirements for Serials Control in ILS

In view of the foregoing, you can now understand that the serials control subsystem of ILS which attempts to provide mechanical means for checking in serials issues, issuing claims, handling binding and other such functions has to be designed very carefully because of the complex nature of serials management. The serials control module of ILS should meet following functional requirements (Mukhopadhyay, 2006):

- New subscription
- Renewal of subscription
- Cancellation of subscription
- Budget control

  Department/unit-wise budget
- Invoice processing

  Invoice for individual issues, or for annual (or other period) subscription
- Recording the receipt of journal issues

  Formula for generating expected issues (predictive mode of serials control)
- Managing (sending claims for) missing issues

  Sending reminders

- Support for domain-specific bibliographic format like MARC 21
- Needs to be able to cope with "special editions", supplements, and indexes
- Should also be able to cope intelligently with name changes (of publication, publisher) and merges or splits (i.e., one journal becomes two, or two join together)
- Binding control
- Accessioning bound volumes

  Barcoding of accession numbers
- Complete holding information for individual title
- Report generation
- Listing the periodical for browsing

  Hyper linking the e-journals from publisher's sites or consortia sites
- Editing and updating of records
- Searching in OPAC

  By title

  By publisher

  By distributor

  Sorting by date or volume/issue number
- Printing of holdings of periodicals and supporting Routing of periodicals
- Options for display holdings and receiving of serials in Web-OPAC
- Table of contents and other personalised information services
- Article indexing (The serials control module should support indexing of journal articles by author, title, and subject keywords)
- Union list and union catalogue (In union catalog the complete holdings information is given along with all its missing issues, discontinuation in subscription, changes in title etc.).

2.5.2 Workflow of Automated Serials Control

The basic workflow of serials control subsystem in ILS may be grouped into four subdivisions – 1) Creation and maintenance of the master database; 2) Subscription and acquisition; 3) Cataloguing and article indexing; and 4) Circulation and binding. These four basic groups of activities include series of tasks. Obviously, the procedures, activities and tasks related to serials control requires frequent and repetitive record addition or amendment. Computerisation is an attractive proposition for serials control because of this reason.

Group I: Creation and Maintenance of Master Database

In serials control module of an ILS, master databases play important role. Any number of addition, modification and deletion is possible in the master database and these changes are automatically reflected in all the sub-modules under that module. It reduces data entry work and ensures standardisation. A typical serials control module includes:

Title master

In this file bibliographical details of new serials are entered (on the basis of standard comprehensive data format like MARC 21 bibliographic format) after the selection and approval process.

Country master

This file contains name of countries and their corresponding codes for entering country of publication data in sub-modules of serials control. Country code is generally based on ISO-3166 where each country is represented by two unique characters e.g. the code of India is **in** as per ISO-3166.

Language master

Now in most of the cases MARC 21 geographic area code (GAC) is used for the purpose. But this file may also contain entries for languages and their three digit codes as per the ISDS manual and CCF manual.

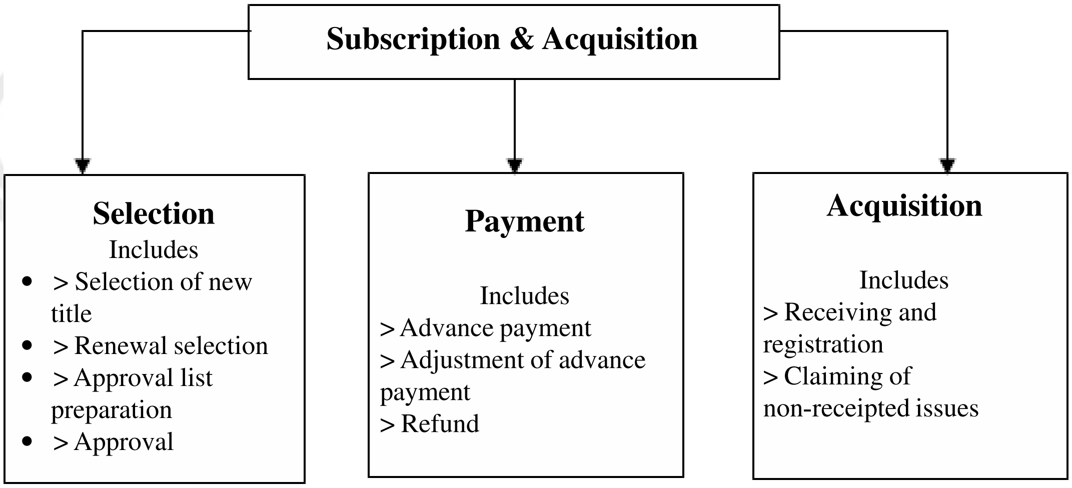
Supplier/Publisher/Binder master

This master file contains details of all local and foreign subscription agents, publisher of serials and binders along with their corresponding codes. These codes are generally created locally.

The above mentioned master files are essential and the other important master tables are – 1) Subject master (holds lists of subject descriptors); 2) Frequency master (holds codes for serials frequencies); 3) Budget master (holds financial data necessary for serials acquisition); 4) Currency master (contains currency description, codes and exchange rate for foreign currencies); 5) Delivering mode master (contains different modes of delivery of serials by publishers and vendors); 6) Physical media master (holds forms, formats and media for serials in coded form); 7) Binding type master (contains different modes of binding (e.g. standard, lather binding, cloth and rexin binding etc.) and their corresponding codes); 8) Letter master (includes formats for every type of letters required for the generation of outputs such as order letter, cancellation of order letter, reminder letters etc.).

Group II: Subscription and Acquisition

The tasks of this group may be organised into three groups and may be represented diagrammatically as below:


Subscription & Acquisition
Selection
Includes
• > Selection of new title
• > Renewal selection
• > Approval list preparation
• > Approval
Payment
Includes
> Advance payment
> Adjustment of advance payment
> Refund
Acquisition
Includes
> Receiving and registration
> Claiming of non-receipted issues

All together, there are 12 basic works in this group of works related to serials control given in the sequence – 1) Selection of serials for new subscription; 2) Renewal or discontinuation of existing journals/serials; 3) Selection of delivery mode; 4) Selection of subscription mode; 5) Formulation of terms of procurement; 6) Selection of vendors; 7) Approval from authority; 8) Ordering and renewal; 9) Payment; 10) Receiving and registration; 11) Reminder generation; and 12) Adjustment of advance payment for non-receipted issues.

Group III: Cataloguing and Article Indexing

The major jobs of this group are –

Cataloguing

Cataloguing formats for serials are fundamentally similar to those of monographs. But the content and format of serials bibliographic records varies considerably between systems. Some catalogues are based on ISBD(s) and others on ISDS formats. Some cataloguing systems use local formats and some use standard format like MARC 21, CCF/B, UNIMARC etc. You may consult the Table 4 in next page for a set of minimum essential tags and subfields related to serials from MARC 21 bibliographic format.

Article indexing

Article indexing option is generally requires by libraries in research institutes. Indexing of articles (also called papers) from journal issues is an optional facility of serials control subsystem. Generally, publishers of primary periodicals produce annual and other sorts of indexes regularly. Apart from such products, libraries also subscribe to number of indexing and abstracting journals related to the areas of their interest. As a result, article indexing is only necessary when available indexing and abstracting services do not cover the core journals on discipline of interest.

Leader	24 characters fixed-length field	
00X group		**Control Fields**
005	Date and time of latest transaction (NR)	
006	Serials – (00-17) – Fixed-length field (R)	
008	Fixed-length data elements – General information (NR)	
0X0 group		**Number and Code Fields**
022	ISSN (R)	[##; $a (NR)]
040	Cataloguing Source (NR)	[##; $a (NR)]
041	Language Code (NR)	[0/1_; $a (NR)]
042	Authentication Code (NR)	[##; $a (R)]
043	Geographic Code (NR)	[##; $a (R)]
082	DDC (R)	[0#; $a (R), $b (NR), $2 (NR)]
2XX group		**Title Related Fields**
210	Abbreviated Title (R)	[0#; $a (NR)]
222	Key Title (R)	[#0; $a (NR)]
245	Title Statement (NR)	[00; $a (NR), $c (NR)]
246	Varying Form of Title	[14; $a (NR)]
260	Publication, Distribution etc.	[##; $a (R), $b (R)]

3XX group		**Physical Description etc. Fields**
300	Physical Description (R)	[##; $a (R), $b (NR), $c (R)]
310	Current Publication Frequency	[##; $a (NR)]
362	Dates of Publication etc.	[1#; $a (NR)]
5XX group		**Note Fields**
500	General Note (R)	[##; $a (NR)]
6XX group		**Subject Access Fields**
650	Subject Added Entry-Topical Term (R)	[#0; $a (NR), $v (R), $s (R)]
653	Index Term – Uncontrolled (R)	[##; $a (R)]
7XX group	**Added Entry Fields**	
710	Added Entry – Corporate Name (R)	[1#; $a (NR), $b (R)]
770	Supplement/Special Issue Entry (R)	[0#; $a (NR), $t (NR), $x (NR), $w (R)]
780	Preceding Entry (R)	[0-0/7; $a (NR), $t (NR), $x (NR), $w (R)]
780	Succeeding Entry (R)	[0-0/8; $a (NR), $t (NR), $x (NR), $w (R)]
841-88X group	**Holdings, Location, etc. Fields**	
850	Holding Institution (R)	[##; $a (R)]
852	Location/Call Number (R)	[##; $a (NR), $b (R), $c (R)]
856	Electronic Location and Access (R)	[##; $u (NR), $s (R)]

Table 4: Data elements (minimum) for serials on the basis of MARC 21 bibliographic format (R=Repeatable field and NR= Non-repeatable fields)

Group IV: Circulation and Binding

This group includes following jobs –

Circulation

Circulation of serials is often referred as Routing of journals. Circulation pattern of serials differs largely from that of books. But if serials are available for ordinary loan, then the same circulation control system will suffice as for monographs. However, serials are generally reserved for reference use only. In special libraries, the short time loan options for journals are common because of the specific need of users. If the number of transactions per day is large enough then such transaction system may be computerised. Such computerised facility must have a list of serials taken, a list of users and their addresses, and transaction interface with options for the generation of required output.

Binding

Back volume management is an important job in serials control. It is a valuable feature of computer based serials control subsystems to inform the library staff of volumes that have been completed and are now ready for binding. It is a very helpful feature to assist in work scheduling and to spread the binding load to give an even distribution of work in the binding throughout the year. After binding of back volume of a journal, accessioning is done for the bounded volume and then holding information for the concerned journal is changed / modified in the bibliographic database of journals.

2.5.3 Products and Advantages

The output of products of an automated serials control subsystem may be grouped into three basic categories – OPAC (gives search option for journals, journal articles and journal holdings), Reports and lists (provides status reports and MIS reports for decision making) and information products (such as table-of-contents and other altering services including SDI). OPAC of an ILS allows searching serials by Title (Current title, Complete holdings, Key title, Linked title, Variant title), Subject (Broad subject heading, Subject divisions, descriptors and class number), Publisher, Title history (Title split, Title merge, Title change, Title holdings), ISSN and Free text. Several reports, letters and statistics can be generated by the automated serials control system such as List of suggestions, List of approved titles, List of titles ordered, List of issues received, List of non-receipted issues, List of missing issues etc. In serials control module of an ILS information products are originated either from article indexing activities or serials catalogue database and produced on demand such as List of recent arrival for issues of a group of journals (as selected by users), List of journal available on a particular discipline, Discipline-wise holding list of serials, Table of contents service of a group of journals (as per user selection), Compilation of on demand subject bibliographies, CAS and SDI services in online and offline mode etc.

Serials management is a complex process. This subsystem involves frequent and repetitive record addition or amendment. Computerisation is an attractive proposition for serials control because of this reason and it leads to following advantages –

- Generates various reports in required formats for MIS activities as decision support tool for serials control (requires for addition, deletion and continuation of journals);
- Ensures timely reminders generation for missing issues and better binding control for completed volumes;
- Offers easy and simple solutions for fund accounting, payment management and budget control, a critical requirement for serials control;
- Facilitates creation and maintenance of article indexing database and thereby generates number of user services on demand;
- It helps library staff in quick production of serials holdings and list of recent arrivals in many forms;
- Facilitates online access to the serials database from anywhere at any time in any format;
- Predicts the arrival of journal issues and generates schedules for receiving journal issues;

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

8) Discuss Kardex management in serials control module of an ILS.

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9) What is a predictive mode of serials control? Discuss its advantages in library automation?

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2.6 CIRCULATION SUBSYSTEM IN ILS

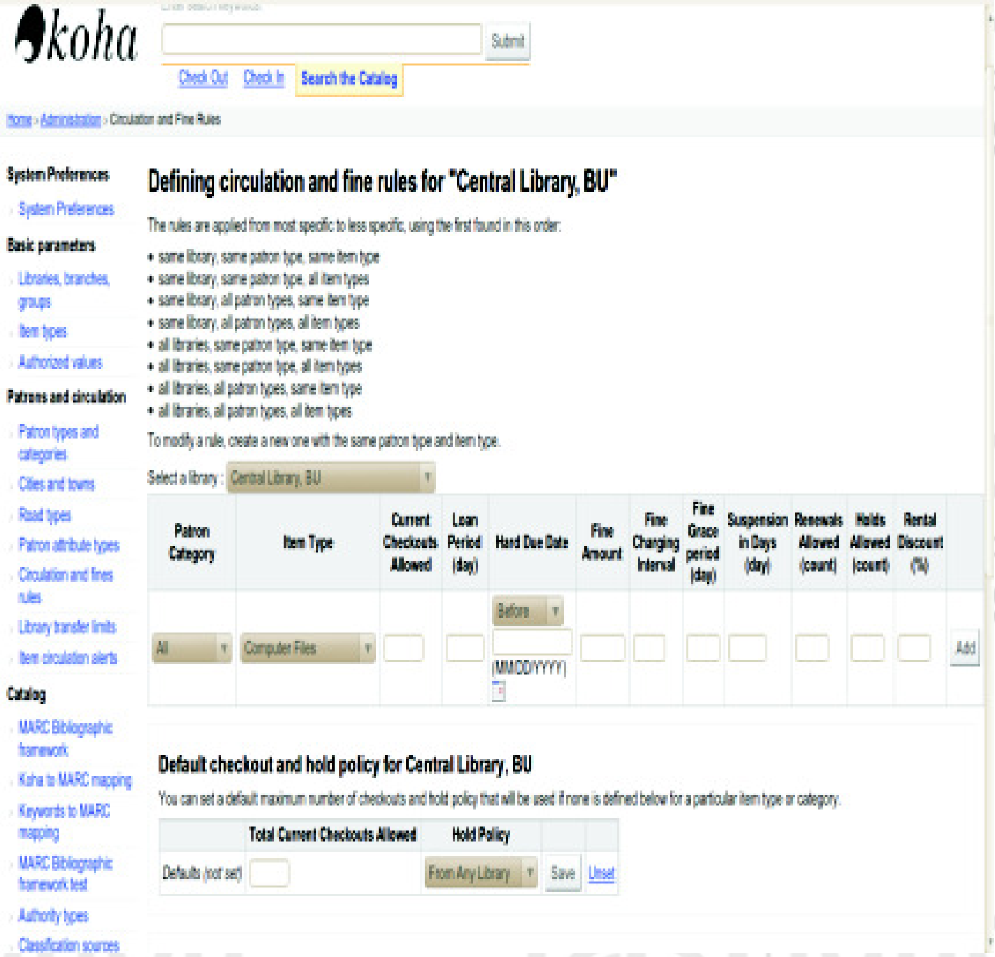
Circulation module of ILSs are effective tool for managing issue, return, renew, reservation and fine calculation easily and quickly. A circulation subsystem in ILS records loan transactions to specify – What material is in the library stock or readily accessible on ILL; Which material is in loan, and from whom or where it can be retrieved and When materials on loan will next be available in library for other users. In ILS, the transaction or loan database is the core of circulation subsystem. This database comprises a series of records, one for each transaction. Each record includes a brief dataset that specifies details of the document (through document number such as accession number), details of the user (through membership code) and transaction details (e.g. date of issue & date of return are extracted from the system date, and due date is calculated automatically). In an integrated setup, the bibliographical details (e.g. author, title edition, place and year of publication) of documents on loan are extracted from the catalogue database and the membership database is utilised for collecting user information. Accession numbers of documents are used as the key data elements in first case, whereas membership codes act as pointer to the member database in the second instance. Data-capturing is generally based on barcodes (to encode/decode both accession number for books and member ID from member card) but the use of RFID technologies in circulation are increasing significantly even in libraries of developing countries.

2.6.1 Functional Requirements for Circulation in ILS

Computerised circulation subsystems generally perform a group of functions utilising three basic categories of information – Information about the borrower; Information about the resources being borrowed; and Information about the loan transaction. An automated circulation system should provide facilities for managing the above mentioned three categories of information including following support services – 1) To locate circulating items (on loan, reserved by user, at binding, being reprocessed); 2) To identify items on loan (to a particular borrower, to a specific class of borrowers; 3) To record 'personal reserves' for items on loan but desired by another borrower and to issue alerting notice to the library staff on return of the reserved item by a borrower; 4) To print recall notices (for returning overdue items, for renewing of items); 5) To arrange renewal of loan; 6) To notify to the library staff of overdue items and printing of overdue notices; 7) To calculate fines or overdue charges for generating (printout of fine notices, receipts of fines records, printout of fine receipts); 8) To generate statistical reports (document related, user related, top ten items by popularity, top ten user by circulation activity etc); 9) To extend provision for handling special categories of borrowers and special types of materials; 10) To generate and print gate pass and due date slips; 11) To act as decision support system for better circulation management; 12) To support various data capturing devices e.g. barcode readers, smart card and RFID equipments; and 13) To extend facilities for ILL and maintenance activities.

2.6.2 Workflow of Automated Circulation

The workflow of automated circulation subsystem starts with defining library circulation rules. Modern ILSs supports branch management system in circulation. It means if a library has branches, each branch may have their own circulation rules and one circulation module will serve all the branches on the basis of circulation rules of that branch. Circulation rules match patron category with item types by defining number of checkouts, loan days, fine amount, grace period, number of renewals, number of reservations etc.



Defining circulation and fine rules for "Central Library, BU"

The rules are applied from most specific to less specific, using the first found in this order:

- same library, same patron type, same item type
- same library, same patron type, all item types
- same library, all patron types, same item type
- same library, all patron types, all item types
- all libraries, same patron type, same item type
- all libraries, same patron type, all item types
- all libraries, all patron types, same item type
- all libraries, all patron types, all item types

To modify a rule, create a new one with the same patron type and item type.

Select a library : Central Library, BU

Patron Category	Item Type	Current Checkouts Allowed	Loan Period (day)	Hard Due Date	Fine Amount	Fine Charging Interval	Fine Grace period (day)	Suspension in Days (day)	Renewals Allowed (count)	Holds Allowed (count)	Rental Discount (%)	
All	Computer Files			Before (MM/DD/YYYY)								Add

Default checkout and hold policy for Central Library, BU

You can set a default maximum number of checkouts and hold policy that will be used if none is defined below for a particular item type or category.

	Total Current Checkouts Allowed	Hold Policy		
Defaults (not set)		From Any Library	Save	Unset

Fig. 2.9: Circulation rules setting option in Koha ILS

The other broad groups of activities for the workflow of automated circulation are:

Membership Management

This sub-module is basically meant to crate and update membership records in a library. The works of this sub-module are – 1) Master database creation and maintenance facility; 2) Member category and privileges management; 3) Institute profile and profiles of Departments/Divisions under the institute; 4) Calendar to record weekdays and closed days for library; 5) Member enrollment facility including modification/deletion/renewal of membership; 6) Output generation facility.

Transaction Management

Transaction sub-module includes all the day-to-day activities of circulation section of a library vis. issue, return, renewal, reservation, reminders for overdue books, searching document availability and listing of items issued to a member.

Reminder Generation

This facility is meant for generating reminders for overdue documents – To a group of members, To individual members, For a particular due date, To all members. The format and text of reminder letter may be modified by using this facility or by using the master database.

Fiscal Management

It provides option to manage outstanding dues against a member. It also includes generation of payment receipt. Fine amount may be waiver by authorised staff. This facility should also allow printing of fine statement if a member wants to have a statement of fines.

Inter Library Loan (ILL)

Inter library loan method simply means that documents of a library can be issued to the members of other libraries. ILL activities of an ILS are - ILL membership management; ILL transactions management; and ILL supervision.

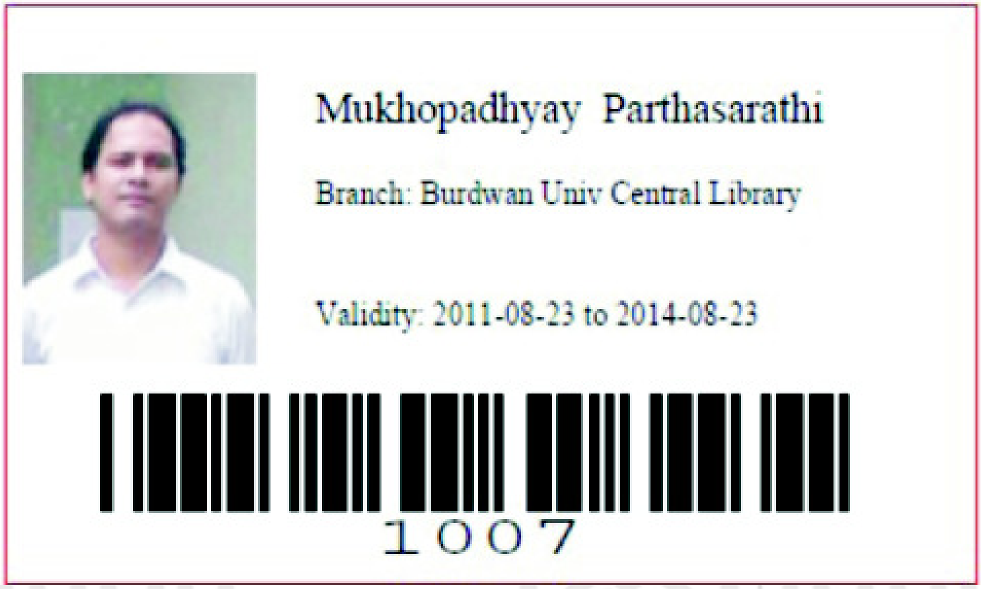
Maintenance

Maintenance is generally attached with circulation module for recording information about lost documents, documents sent for binding, damaged documents, missing documents and documents withdrawn from library.

2.6.3 Products and Advantages

The typical products or outputs from automated circulation subsystem in an ILS are –

- List of library members (list of members can be printed either by name or by member code and can be sorted on any required sequence or order);
- Items issued over a period (list of documents issued on a particular date or date range);
- Items returned over a period (list of documents returned on a particular date or date range);
- Items reserved over a period (list of documents reserved on a particular date or date range);
- Member ID card (Member ID card with name of the member, membership code, department, institute, category, branch and year may be printed by utilising appropriate facility); Fig. 2.10 shows the member card generation utility in Koha ILS. You can observe the ability of the ILS to convert member ID into corresponding barcode.



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Validity: 2011-08-23 to 2014-08-23

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Fig. 2.10: Bar-coded member card generation in Koha ILS

- Reminder letters and notifications (preformatted reminder letters for overdue document(s) is a regular task of circulation section);
- Item's transaction history (transaction history of any particular document);
- Membership expiry list (list of memberships expiring on a particular date or date range);
- Member history (list of documents issued and returned by a member during his/her membership period);
- Fiscal report (details of the fines collected by the library on a particular date or date range);
- Library usage (usage by deferent category of library members or by usage of different types of library materials);
- Most frequently issued items (list of most frequently issued documents);
- Most frequent member (list of most frequent users by circulation activities).

The other important products are –

- List of items issued to a member;
- 'No dues' certificate;
- ILL reports (arrival intimation, reminder, list of items on ILL, overdue charges and payment receipts);
- Transaction details undertaken by a staff working at circulation;
- List of lost, missing or damaged documents;
- List of lost documents for which amount recovered;
- List of documents sent to binding;
- Order letter for binding;
- List of withdrawn items.

The main advantage of automated circulation subsystem is the ability of library staff in extensive control of stock. Transaction records can be entered and saved into the main database through a terminal. The central transaction database is updated immediately and subsequent consultation of the database will communicate the current situation. Some of the important issues may be enumerated as – Fines can be calculated on demand; Reservation and other modification to document records can be made instantly; Automatic identification of over borrowing and problem borrowers; Error-free data capturing through barcode, RFID and smart card technology; Provision of self-checking or self-issue option through web interface; Back up provision and exchange of circulation records on the basis of NCIP (NISO Circulation Interchange Protocol) standard.

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

10) "Automated circulation is fairly successful right from the eighties"– elucidate.

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11) Explain the use of RFID in automated circulation.

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2.7 SYSTEM ADMINISTRATION

System administration of ILS is not regular and repetitive in nature but the working of each modules of ILS activated after configuration of each module as per the requirements of library through system administration interface. System administration involves two sets of works – 1) Setting of initial configuration for each module; and 2) Adjustment of configuration settings from time-to-time to match requirements of library. Post-installation configuration of an ILS is required to make the default installation of ILS library specific. Only super user of ILS can set the administrative parameters. The typical system administration jobs are listed herewith –

General parameters

- Date format: Selection of "metric," "us," or "iso" date format for entire ILS ("us" = mm/dd/yyyy; "metric" = dd/mm/yyyy; "iso" = yyyy/mm/dd);
- Tax parameter: Setting of tax (generally in percentage) for acquisition of documents;

- Parameters for Authorities: Involves decisions regarding Authority Display Hierarchy and Authority separator;
- Default character encoding: Selection of character encoding standard for whole ILS, usually Unicode for multilingual data;
- Theme selection: Selection of themes for appearance for both librarian and user interfaces;
- Branch management: Option for setting managing parameters for library branches.

Cataloguing parameters

- Allows settings of the following parameters for cataloguing activities – default dispaly format for retrieved documents, default data format (MARC, UNIMARC etc.), Auto/manual barcode generation, Filing rules etc.

Circulation parameters

- Allows parameters setting related to maximum outstanding fine amount, maximum reservations allowed, patron image display, notification for borrower expiry, generation of gate pass etc.

OPAC parameters

- Supports setting for the following parameters related to OPAC – enhanced content linking (like Amason etc), suggestions by users from OPAC, virtual shelf management.

Library Branches: Options for setting library code, name, address, IP address, domain name etc.

Library Funds: Setting of budget heads for different library materials as per the decision of the authority;

Currencies: Define the currencies library deal with exchange rates.

Item Types: Setting "categories" into which library items are divided.

Borrower Categories: Setting definition for the types of users of library and how they will be given privileges.

Issuing Rules: Controls aspects related to the circulation of library materials.

Authorised values for bibliographic format: Options for setting list of authorised values for different tags and sub-fields of selected bibliographic format.

Bibliographic framework: Scope for customising of data entry framework by selecting require tags and sub-fields.

Printers: Setting of printers (or several printers) that is attached to ILS server.

Stop words: Provision to list all of the words library staff wish to ignore by ILS when performing catalogue searches or building the keyword index.

Z39.50 Servers: Adding Z39.50 servers library want ILS to search.

Export/Import: Settings for performing export/import activities by following standards like ISO-2709 and MARC-XML.

Backup/Restoration: Regular backing up databases and restoration at the time of emergency.

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

12) What do you mean by system administration? List some major jobs covered by this module.

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2.8 SUMMARY

This Unit starts with a theoretical discussion on system analysis and shows the application of procedural model to analyse tasks related to housekeeping operations under different sections of a library. It discusses library automation processes in integrated setup under four major subsystems namely acquisition subsystem, document processing subsystem, serials control subsystem and circulation subsystem. Each subsystem includes three major heads of discussion uniformly. The heads of discussion are functional requirements for the subsystem, workflow of the subsystem and advantages of automating the subsystem including typical products of the automated subsystem. Functional requirements section argues what an ILS should support and workflow section discusses how an ILS may be utilised for automating the subsystem. This unit ends with a discussion on system administration jobs related to library automation.

2.9 ANSWERS TO SELF CHECK EXERCISES

1) Library workflow or housekeeping operations are basic functions of any type or size of library. The works include acquiring, processing and preserving of library documents. The circulation of documents and maintenance of library stack is other important works of library housekeeping. These works are done through various divisions/sections of a library namely acquisition, processing, circulation, serials control and maintenance. These are basically routine and recurring works. Mechanisation of such works may be done through the application of ICT tools e.g. computer hardware and software (called ILS).

2) Serials control is concerned with the management of operations of journal section of a library. These are subscription, renewal, order, payment, cheek-in or receiving, reminder, binding and accessioning of bound volumes. Such activities lead to various information products and user services.

3) System analysis is technique for the analysis of components of a organisation and its works into atomic structure. Library is a complex system and consists of various subsystems and components. ASLIB, on the basis of system analysis techniques, identified a set of eighteen procedures related with

different subsystems. The same study also identified six common activities for all the eighteen procedures. These are – initiate, authorise, activate, record, report and cancel. All of these activities may not be applicable for each procedure. These procedures and activities are common to each type or size of library. An ILS should cover procedures, activities and tasks related to each subsystem of a library. Therefore, system analysis is a powerful tool for implementing an ILS.

4) Acquisition module of any ILS requires some essential works that need to be done before proceeding with actual acquisition work. These are termed as pre-acquisition works. This set of activities include – creation of master file for vendors/publishers/suppliers, creation and maintenance of currency conversion table, budget allocations under different heads, setting pre-defined letters for ordering etc, member creation and privilege setting.

5) Acquisition module of an ILS reduces a great deal of routine clerical chores in acquisition, supports online data entry and Electronic Data Interchange (EDI), generates reminders for overdue orders and sends them automatically over communication channel, provides real-time fund accounting, transfers bibliographical data of newly acquired items entered in the acquisition module to catalogue module for necessary modifications and up-gradation. Such a system helps to introduce new user services and cheaper data processing. It generates reports, statistics and lists required for the better library management and planning of efficient library services. Another advantage of automated acquisition system is to provide ready answers against queries related to the status of requests or orders.

6) Distributed cataloguing is a form of shared cataloguing and cooperative cataloguing. It allows online capturing of bibliographic data from remote library servers over the Internet. It reduces unit cost of cataloguing and saves lot of time for individual libraries. However, the major problem is of variation in data formats, software and hardware. ANSI/NISO Z39.50 standard was developed to support distributed cataloguing and to overcome the problems of database searching with different search languages. Z39.50 is a session oriented program-to-program open communication protocol based on client-server computing model. ILS incorporated with Z39.50 copy-cataloguing client (called origin in the standard) submits a search request to any Z39.50 server (called target), which then process the request and returns the result in desired standard. ILS will then place the captured record in the catalogue editor for changing and modifying bibliographic data in local library.

7) MARC 21 is a family of five coordinated formats developed 1999 through conciliation of major national MARC formats like USMARC, UKMARC, CANMARC etc. The five standards are namely - MARC 21 format for authority data, bibliographic data, classification data, community information and holdings data. MARC 21 is mainly a development over USMARC, and has become the de facto bibliographic standard in the area of computerised cataloguing since the beginning of 21^{st} century.

8) Kardex management basically deals with loose issue management of journals in a library. It is also known as Cheek-in operation. It involves works related

to the receiving and registering of individual parts or issues of serials in library. It is necessary to make a careful note of the arrival of every issue of all periodicals along with special issues, indexes or other accompanying materials. Reminder generation for non-receipted issues depends largely upon this function.

9) Predictive mode of serials control means the ability of the ILS to predict the arrival of individual issue of a journal and to generate reminders automatically in case of non-receipted issues or parts within a stated time interval. An automated serials control subsystem may be predictive or non-predictive. A predictive serials control system saves labour, energy, time and money and ensures timely delivery/release of reminders for due issues of journals.

10) Circulation work of a library involves a group of operations that are specific, repetitive and systematic. As a result automated circulation systems have been fairly successful from the early days of library automation. Such systems require minimum set of essential data for carrying out circulation activities and data may be captured in a variety of ways. In an academic library, where users are generally large in number, this automated subsystem saves time of the users in great way.

11) Automated circulation subsystems are now-a-days RFID-enabled for many reasons. Libraries apply RFID (Radio Frequency IDentification) technology to manage un-manned self-service counters for issue and return of documents. An RFID system comprises three components: a tag, a reader and an antenna. The tag is paper-thin chip, which stores necessary bibliographic data. The tag is to be placed on the inside cover of the corresponding document. RFID reader and antenna are often integrated into patron self-checkout machines or inventory readers. The reader powers the antenna to generate RF field to decode information stored on the chip. Reader sent information to the central server, which in turn communicates with the ILS. RFID, apart from self-issue facility, also supports stock verification, theft detection (through EAS gate), and identification of misplaced books and inventory counts.

12) The administrator or super user should control the overall administration of ILS through a highly secured module for managing access control - for individual user, for each module and for each function; system security to prevent unauthorised access to databases; standard implementation and setting of system parameters and keep a log of each transaction, which alters the database. The other important jobs of system administration are privileges control, branch management, backup and restoration and System configuration.

2.10 KEYWORDS

Backup : Storage of records in magnetic or optical media for recovery of data at the time of need.

Barcode : A barcode is simply a computer readable tag that is used to identify individual items and patrons that are related to a specific library database.

Boolean Operators : The words AND, OR, and NOT used to combine concepts or search terms when searching a database for information.

Budget Allocation : It is the distribution of total library budget into various budget heads and subheads.

Charging : It is the act of 'issuing' a document and to record the loan transaction.

Check-in : The act of receiving and recording arrival of individual parts of serials.

Common Communication Format (CCF) : The CCF was developed by the General Information Programme (PGI) of UNESCO in order to facilitate exchange of bibliographic data between organisations, and first published in 1984. It is a highly compatible format that provides a structure in which records may be entered to the system; a format best suited to long-term storage; a format to facilitate retrieval and a format for display.

Data field : In a record, a meaningful collection of one or more related characters treated as a unit. In bibliographic records, these are variable length portion containing a particular category of data.

Directory : A table of entries, each of which gives the tag, length, and location within the record, segment identifier and occurrence identifier of one data field.

Discharging : The act of cancelling the records of documents on loan after their return.

Indicator digit : The first two characters of each data field, supplying further information about the contents of the field.

Intranet : The network that uses Internet technologies (TCP/IP and others) for local connectivity and is available only to the members of the network.

ISDS : An acronym for International Serials Data System. An international network of operational centers (established in 1973 within the framework of UNISIST programme), which are jointly responsible for the creation and maintenance of computer-based databank, and facilitates retrieval of scientific and technical information in serials.

ISO-2709 : An international standard for bibliographic information interchange on magnetic tape, developed in 1981. Most of the content designator schemes constitute a specific implementation of this standard.

ISSN : Acronym for International Standard Serial Number – an internationally accepted code for the identification of serials publications. It consists of seven Arabic digits with an eighth that serves to verify the number in computer processing.

Mandatory field : A data field, which should appear in the record when the relevant information appears on the item.

MARC 21 : MARC 21 is a family of five coordinated formats namely MARC 21 format for authority data, bibliographic data, classification data, community information and holdings data. MARC 21 is a development over USMARC, and has become the de facto bibliographic standard in the area of computerised cataloguing.

Merging of Title : It refers to combine two or more journals into a single journal under one title.

Record : A collection of information, in one or more fields, about an entity.

Repeatable field : A data field, which may appear more than once in the same segment.

Repeatable sub-field : A subfield, which may appear more than once in a single occurrence of the data field to which it belongs.

Reservation : A request for a specific book or other circulating items to be reserved for a member as soon as it becomes available on completion of processing, or on its return from the binder or another member.

Routing : The systematic circulation of periodicals or other printed material among the staff or members of a library in accordance with their interests in order to keep them informed of new developments.

SDI : Abbreviation for Selective Dissemination of Information Systems. It is an automated system of information retrieval utilising a computer for disseminating relevant information to users. An interest profile depicting and defining each area of interest is compiled for each user; it consists of terms, which are likely to appear in relevant documents.

Splitting of Title : The breaking of a single journal into two or more different journal titles.

Standing Order : An order to supply each succeeding issue of a serial publication or subsequent volumes of a work published in a number of volumes issued intermittently.

Sub-field : A separately identified part of a data field containing a data element.

Sub-field identifier : Two characters immediately preceding and identifying a subfield. First character is called subfield flag and the second character is termed as subfield code.

System Analysis : A powerful technique for the analysis of an organisation and its work.

Tag : A three characters code appearing in the directory, associated with a data field and used to identify it.

Union Catalogue : A catalogue of the various departments of a library, or a number of libraries, indicating their locations. Union catalogue of serials includes the complete holding of serials available in member libraries.

Withdrawal : The process of cancelling records in respect of documents that have been withdrawn from the stock of a library.

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UNIT 3 LIBRARY AUTOMATION – SOFTWARE PACKAGES

Structure

3.0 OBJECTIVES

After going through this Unit, you will be able to:

- understand historical background, evolution and generation of library automation software packages;
- categorise library automation software as per origin and distribution policies;

- identify features and specialties of major commercial and open source software packages in the domain of library automation; and
- know the processes for evaluating library automation packages and understand the trends in developing library automation software packages.

3.1 INTRODUCTION

In this Unit we are going to study the library automation packages. We have already covered different aspects of library automation in Unit 1 and processes and workflows of library systems in Unit 2. This Unit aims to introduce you to the applications of library automation software for different workflows in a library system and its roles in providing information services to users and MIS services to library staff. Mukhopadhyay (2006) outlined the role of typical library automation software for two major subsystems of a library – operational subsystem and administrative subsystem (see Fig. 3.1).

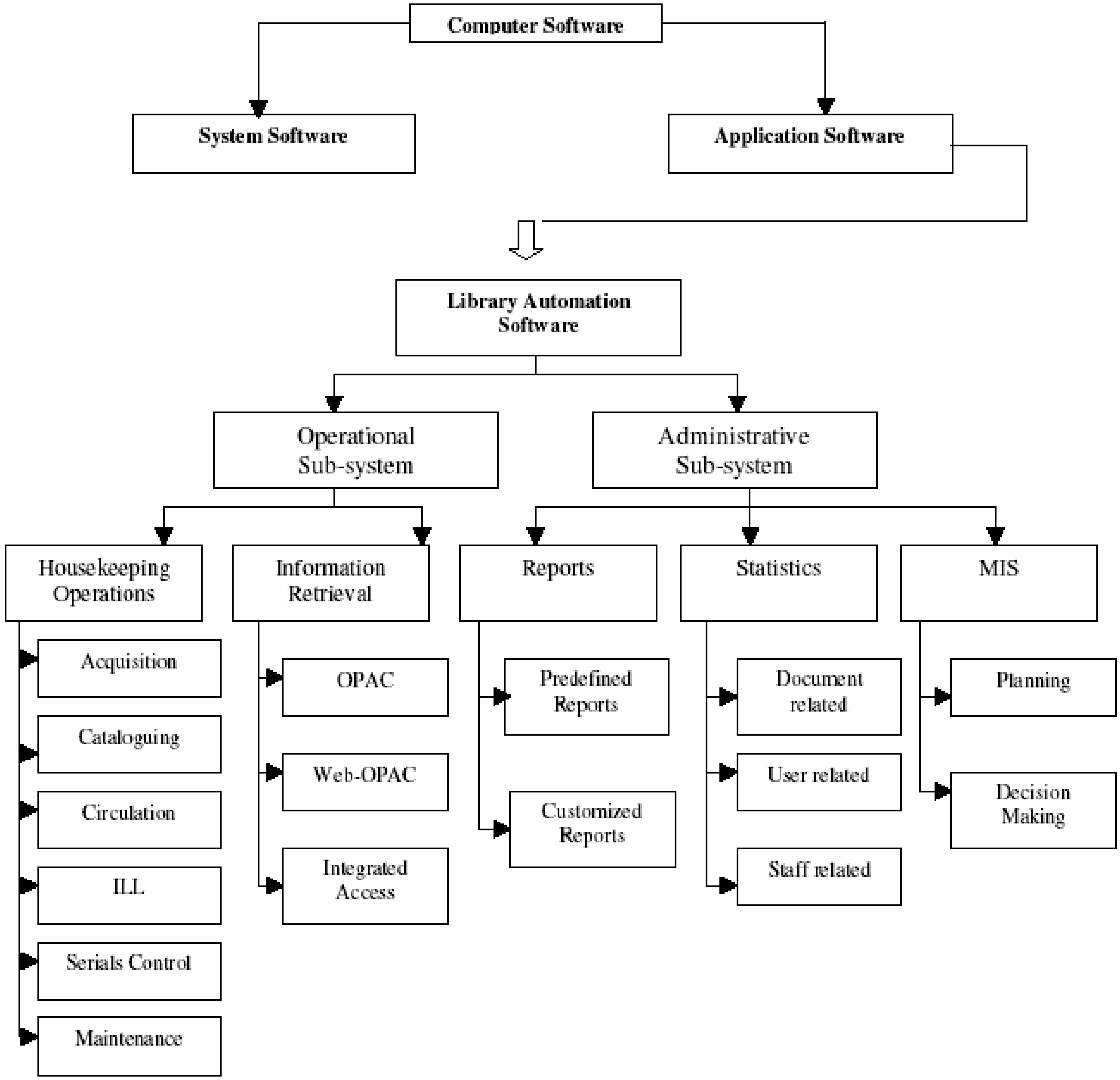

Fig. 3.1: Role of library automation software in integrated setup

Source: Mukhopadhyay, 2006

The above-mentioned roles of an ILS are supplemented by many other value-added features like online acquisition, FRBRised cataloguing, RFID-enabled circulation, member card printing, bar-coding of accession number and member ID, predictive mode of serials control, interactive OPAC, federated searching, extensive reports and statistics in different formats for supporting decision making process etc. Obviously, these enhanced features added into basic core modules over the time, with the improvements in technologies particularly relational data model, web architecture, multilingual technologies, linked open data and with the development of global open standards in the domain of library automation. Presently library automation software are maturing rapidly with the advent of the above technologies.

3.2 HISTORY, EVOLUTION AND GENERATIONS

We already covered the progress of library automation for the last fifty years in Unit 1. This section is trying to associate the development of library automation software with the fundamental improvements in library automation itself.

3.2.1 Historical Foundation

Library automation began in 1930's with the use of punched card equipments in circulation and acquisitions processes in developed countries like US. But you already know from unit 1 that the computer systems applied in automating libraries in late 1960s with the use of low-cost PCs as hardware support and with the development of in-house software for managing processes related to acquisition, cataloguing and circulation. It may safely be said that right from the beginning of library automation, software played the most important role. However, software by definition is the representation of human knowledge in the forms of bits and bytes. In this sense software may be viewed as digital version of human knowledge not just as a set of related programs. Similarly, library automation software are based on knowledge and experiences acquired by library professionals over centuries. These software tools are helping in easy and effective management of housekeeping operations. Such software is also supporting dissemination of information services and helping library staff in administrative activities. Presently almost all library automation software are integrated systems, based on relational database architecture. In such systems files are interlinked so that deletion, additions and other changes in one file automatically activate appropriate changes in related files. The use of library automation software is rapidly increasing in India right from 1995. Almost all special libraries and large academic libraries in India adopted integrated library system. Recently public libraries and college libraries all over the country are either adopting automation software or planning actively to go for library automation with the advent of globally competitive open source ILSs (available free of cost and can be customised extensively). There are also supports from governments in adopting open source ILS, for example, National Library Mission (Ministry of Culture, Govt. of India) advocated to adopt Koha (an open source globally reputed ILS) for automating public libraries, Kerala State Government declared Koha as the official ILS for the public libraries in the state and almost 250 public libraries have already been automated by using Koha in West Bengal. A network of public libraries in Konkan area is automated through Koha (see granthalaya.org). Ministry of HRD, Government of India through it N-LARN project under NMEICT (see n-larn.ac.in) is helping college libraries under UGC and AICTE in adopting Koha for library automation. Overall, libraries in India are moving towards a large-scale implementation of library automation in different parts of the country.

3.2.2 Evolution

You already know after covering the Unit 1 that the library automation process underwent five eras on the basis of technological improvements in computer programming, database management system, network capabilities and web integration. To respond these changes, library automation software also improved considerably through five different generations. Mukhopadhyay in 2006 reported a comparative account of four generations of ILSs. Use of cloud computing, web-scale management, linked open data and web 2.0 technologies initiated the fifth generation of ILSs. This section points out major technological features of five different generations of ILSs and next section (3.2.3) gives a comparative account of five generations of library automation software against the features earmarked by Mukhopadhyay (2006).

- The first generations ILS packages were piecemeal, non-integrated and non-portable across hardware architectures and software platforms. These packages were module-based systems with no or very little integration between modules. Circulation module and cataloguing module were the priority issues for these systems and were developed to run on specific hardware platform and proprietary operating systems;

- The most important achievements in second generation of packages were hardware and platform independence. The second generations ILSs become portable between various platforms with the introduction of UNIX and DOS based systems. The ILSs of this generation offer links between systems for specific functions and are command driven or menu driven systems;

- The most important features in third generation of packages were GUI, seamless integration of modules and relational model based client-server architecture. The third generations ILS packages are fully integrated systems based upon relational database structures and client-server architecture. They embodied a range of standards, which were a significant step towards open system interconnection. Colour and GUI features, such as windows, icons, menus and direct manipulation have become standards and norms in this generation;

- Web architecture, Unicode and digital media archiving were the major attributes of the fourth generation ILSs. The fourth generations ILSs were based on web-centric architecture and facilitate access to other servers over the Internet. These systems were Unicode complaint and allow accessing multiple sources from one multimedia graphical user interface; and

- The present of the fifth generation ILSs are adopting rapidly cutting edge technologies like web-scale management, cloud computing, web 2.0 features on the basis of AJAX (Asynchronous Java and XML) technology, Application Program Interface (API), and linked open data. Rising of open source ILSs and implementation of open standards are also remarkable features of this generation.

The progress of ILSs through five different generations improved functionalities, enhanced user access to library resources in 24X7 mode, facilitated new generation information services, achieved interactive user interfaces, and supported multilingual data processing.

3.2.3 Generation of Packages

Library automation software are categorised into four different generations on the basis of core attributes of the packages like software architecture, programming language, internal DBMS, module integration capabilities etc. (Mukhopadhyay, 2006). This categorisation adopted by many researchers in the domain of library automation (see http://shodhganga.inflibnet.ac.in/ jspui/handle/10603/9406). Table 3.1 provides a comparative study of five different generations of ILSs in the same line with bit modifications in parameters.

Table 3.1: Five generations of ILSs

Sl. No.	Features	1st Generation	2nd Generation	3rd Generation	4th Generation	5th Generation
1	Programming Language	Low level language	COBOL, PASCAL, C	4 GL	OOPS	AJAX
2	Operating System	In house	Vendor Specific	UNIX, MSDOS	UNIX, Windows and Linux	Mainly Linux distributions
3	Data model	Non-standard	Hierarchical and Network model	Entity-Relation model	Object oriented model	Support for FRBR, FRAD and FRSAD
4	Import/Export	None	Limited	Standard	Fully integrated and seamless	Distributed across formats through XML
5	Communication	Limited	Some interface	Standard	Full connectivity across Internet	Support for Linked Open Data
6	Standards support	Limited and proprietary	Improved for bibliographic data	Bibliographic and authority data	Standards for all modules	Emphasis on open interoperability standards
7	Portability	Machine dependent and hardware specific	Machine independent but Platform dependent	Multi-vendor	Multi-vendor and Platform independent	Complete portability
8	Reports and sattistics	Fixed format, limited fields and statistics	Fixed format, unlimited fields and moderate statistics	Customised report generation and wide statistical range	Customised report generation with e mail interface and statistics in different formats	Complete control over report elements and comprehensive statistics generation
9	Media	None	None	Available in limited way	Fully available with Multimedia	All formats for digital objects

10	Capacity of record holding	Limited	Improved	Unlimited	Unlimited	Unlimited
11	Module Integration	None	Bridges	Seamless	Seamless and object oriented	Seamless with API for new modules
12	Architecture	Stand-alone	Shared	Client-Server	Web-centric/ Distributed	Cloud and Web-scale
13	Interface	Command driven (CUI)	Menu driven (CUI)	Icon driven (GUI)	Icon driven with Web and Multimedia (GUI)	Web 2.0-enabled interfaces
14	User Support	Single user	Limited number of users	Unlimited number of users	Unlimited number of users	Unlimited concurrent users
15	Multi-lingual support/ UNICODE	None	Limited (through Hardware support)	Standard	UNICODE based	UNICODE with embedded virtual keyboard for languages
16	External resource integration	None	None	Limited	Improved	Full integration with external datasets
17	Discovery and Federated searching	None	None	None	Limited	Support for federated search
18	Distribution mode	Close and in-house	Close and proprietary	Close and proprietary	Both close and open source	Mainly open source

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

1) Mention typical role of an ILS in library automation.

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2) Make a comparison between 3rd and 4th generation ILSs.

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3) Enumerate features of 5th generation ILS.

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3.3 CATEGORISATION OF ILS

CDS/ISIS, a textual database management software developed by UNESCO in 1985, played an important role of forerunner for library automation in India. This package is not an ILS but provides an excellent framework for managing bibliographic databases such as library catalogue. It is specifically meant for the structured non-numerical databases, powered by a very comprehensive formatting language to control display of records and also provides many advanced level retrieval features. In India, erstwhile NISSAT (national distribution agency for CDS/ISIS) with the help of other professional bodies organised a number of training courses on application of CDS/ISIS (DOS and Windows version) in information organisation activities. As a result, a large pool of trained manpower developed all over the country. Some organisations from the experience of use of CDS/ISIS, MINISIS etc. developed their own ILSs e.g. DESIDOC developed DLMS (Deference Library Management System), INSDOC came with CATMAN (Catalogue Management) and SANJAY was developed by DESIDOC under NISSAT project by augmenting CDS/ISIS (Version 2.3) for library management activities. So we may say that first era of ILS in India dominated by ILSs developed in house such as DLMS, CATMAN and SANJAY. This trend is followed by commercial software firms in developing comprehensive full-featured ILSs in India. The era of commercial ILS is dominated by ILSs of foreign origin (such as Virtua ILS), ILSs developed in India by using foreign ILS (such as BASISPlus and TECHLIBPlus) and ILSs of purely India origin (such as LibSys, E-Granthalaya). However, the scenario of library automation in India has changed from 2001 onwards with the availability of open source ILSs which are available freely, customisable and based on global open standards in the domain of library automation. In this section we are for categorising ILSs available in India on the basis of two different train of characteristics – distribution policy (close source and open source) and place of origin (foreign origin, Indian origin and hybrid).

3.3.1 Categorisation by Distribution Policy

You know that software of any kind can be grouped into two fundamental categories – system software and application software. This grouping is based on the application levels of software. System software (such as operating system) is related with the management of resources in a computer system whereas an application software are designed to perform certain tasks such as database management (DBMS software), word processing (Word processing software), image processing (Graphic software) etc. Library automation software is an application software and manages library automation activities. On the other hand, as per the distribution policy (conditions for availability of software), software may be grouped into two broad divisions – close source software and open source software (OSS). Close source ILSs are available against license fees (one time capital expenditure and recurring annual maintenance fees) or freely (a few close source ILS are available freely e.g. e-Granthalaya) without source codes. It means users cannot customise or modify the source code of ILS. Close source software therefore, may again be placed in two groups – commercial software and freeware. Open source software, on the other other hand, available freely with full freedom to customise the source code as per the requirements of the library. So, as per the distribution policy, the whole array of ILS may be categorised into three groups – Close source commercial ILS, Close source freely available ILS, and Open source ILS (see Table 3.2 with illustrative examples).

Table 3.2: Categorisation of ILSs by distribution policy

	Types of Library		
Distribution policy	**Large Library Systems**	**Medium Range Library Systems**	**Small Library System**
Close source ILSs (Commercial)	• VIRTUA ILS • LibSys	• SLIM 21 • SOUL	• AUTOLIB • NIRMALS
Close source ILSs (Freeware)	• ABCD	• e-Granthalaya • WEBLIS	• LAMP • Librarian
Open source ILSs (Freely available)	• Evergreen ILS • Koha (version 3.x)	• Koha (version 2.x) • NewGenLib	○ Emilda ○ PHPMyLibrary

Please remember the examples are only illustrative not comprehensive. There are several ILSs in use in Indian libraries both from commercial and open source domains. In the close source group the LibSys and SOUL are dominating ILSs, and in the open source group Koha and NewGenLib are the most popular ILSs. Some libraries in India are using WEBLIS which is based on CDS/ISIS. It has already been mentioned that the availability of open source ILSs helped in large-scale library automation in India as far as school libraries, college libraries and public libraries are concerned. Till date around fifteen open source ILSs are available for use. However, we may go for categorising open source ILSs as per the maturity level in terms of architecture, data model, core modules, support for standards, multilingual data processing ability, user services and interoperability. The Kuali ILS is an experimental open source library automation software as it is trying to implement the OLE and ILS-DI recommendations for developing the next generation automated library system.

Table 3.3: Categorisation of open source ILSs by maturity level

Categorisation of Open source ILS by Maturity Level			
Fairly matured	**Moderately matured**	**Infancy**	**Experimental**
• Emilda • Evergreen • Koha (version 3.x onwards) • NewGenLib	• MiniSOPULI • OPALS • OpenBiblio • OtomiGenX • phpMyLibrary	• Avanti • e-library • PHPMyBibli • PMB • PYTHEAS	• Kuali ILS

3.3.2 Categorisation by Place of Origin

Mukhopadhyay (2001, 2005) grouped ILSs available in India on the basis of place of origin. This grouping later on was adopted by many researchers in the field. It includes three fundamental categories – ILSs of foreign origin, ILSs developed over ILSs (or textual database management systems) of foreign origin and ILSs of Indian origin. This grouping may again be sharpened by dividing the packages on the basis of size of library systems i.e. large library system, medium range library system and small range library system.

Table 3.4: Categorisation of ILSs by place of origin

Application Domain			
Origin	**Large System System**	**Medium Range**	**Small System**
ILSs of foreign origin	• Alice for WINDOWS • Evergreen • Koha (ver 3.x) • Virtua ILS	• Koha (ver 2.x) • Emilda	• phpMyLibrary • OpenBiblio • PMB
ILSs developed over ILS of foreign origin	• NG-TLMS.NET (over TLMS package)	• WINSANJAY • ABCD (Over CDS/ISIS)	• LAMP • WEBLIS (Over CDS/ISIS)
ILSs of Indian origin	• LIBSUITE • LIBSYS • MECSYS • NEWGENLIB • NEXLIB • SLIM 21 • SOUL • SUCHIKA • TULIPS • ULYSIS • WILISYS	• AUTOLIB • DLMS • GRANTHALAYA • LIBRA • LIBRARIAN • LISTPLUS • NETLIB • NIRMALS • SLIM ++	• ARCHIVES • CATMAN • E-GRANTHALAYA • GOLDEN LIBRA • LIBMAN • Library- Manager • LIBRIS • LIBSOFT • LOAN-SOFT • SALIM

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

4) What is an open source ILS? List some major open source ILSs.

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5) Categorise ILSs available in India with example.

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3.4 OPEN SOURCE SOFTWARE PACKAGES

Free/Libre Open Source (FLOSS) or simply Open source ILSs are maturing day-by-day and increasingly considered as viable alternatives to commercially available ILSs. Some of the open source ILSs are taking technological lead in cutting edge technologies, such as Koha is considered as leader in developing the model OPAC 2.0 (through integration of Web 2.0 tools like RSS, virtual shelf browsing, user-driven tagging, provision of book reviews by users, information mashp with Amason, Syndicate, LibraryThing, Open Library etc.) and in developing Z39.50 server facility for distributed cataloguing (most of the commercial ILSs only include Z39.50 client). Apart from these technological advantages, open source ILSs provide many other benefits such as –

- **Community ownership**: Users are considered as co-developers and there is no single owner of the ILS, rather user libraries are considered as stake-holders of the product;

- **Vendor independence**: Open source ILSs are free from vendor-lock in. It means libraries are free to hire expertise at the time of requirements;

- **Smooth migration**: If user library decides to switch over from one open source ILS to another ILS (commercial or open) the data migration is quite smooth and loose-less. But the migration from commercial ILS to open source ILS is not always an easy task due to problematic data transmission for obvious commercial reasons;

- **Use of open standards**: Open source ILSs use open standards for most of the work-flows and activities and thereby ensure transparent library operations;

- **Customisation**: No two libraries under the Sun run in the same way. Commercial ILSs provide a fit-to-all-size solution for libraries of any type or size. And these software cannot be customised as source codes are not available. Open source ILSs allow libraries to customise the source code to meet the requirements of individual libraries;

- **Fund savings**: As open source ILSs are available at no cost or at nominal cost, the library budget for software procurement and annual maintenance of the ILS may be utilised in other areas of library development;

- **Freedom**: Open source ILS allows librarians to operate at the system level whereas in commercial ILSs the role of librarians reduced to mere data entry operators. Apart from this benefit, open source ILSs provide freedom to use, modify and distribute the software on the basis of GPL (GNU General Public License); and

- **Fraternity**: Open source ILS supports fraternity in library community at the international level through cooperation, sharing of expertise and experiences.

A detail account of philosophies and principles of open source software is available in the next Unit i.e. Unit 4 in this block. However, in this section we are going to study the features of some matured open source ILSs that are globally reputed for their features, architecture and respectable user base (number of active users of the ILS). Presently fourteen ILSs are available against licensing agreements and these are Emilda, Evergreen. Gnuteca, InfoCid, Jayuya, Koha, NewGenLib, oBiblio. OPALS, OpenAmapthèque, OpenBiblio, PhpMyLibrary, PMB and Senayan. Müller (2011) in his study categorised the open source into two levels – i) Maturity of ILS Community; and ii) Maturity of ILS Functionality. Each of these two categories have divisions. For example, Müller divided the category ILS community into four divisions namely Inactive community, Just released community, Emerging community and Sustainable community against weight based decision matrices. The result is given below:

Category	FOSS ILS name
Sustainable	Evergreen, Koha
Emerging	PMB
Just Released	Gnuteca, InfoCID, NewGenLib, oBiblio, OPALS, Open Amaptheque, Senayan
Inactive	Emilda, EspaBiblio, Jayuya, OpenBiblio, PhpMyLibrary

Source: Müller, T. (2011). How to choose a free and open source integrated library system. *OCLC Systems & Services*, *27*(1), 57-78.)

Similarly, rating by maturity of functionalities of open source ILSs in the above research study shows the following result:

Categories	FOSS ILS name
Mature	Koha
Improving	Evergreen, PMB

Source: Müller, T. (2011). How to choose a free and open source integrated library system. *OCLC Systems & Services*, *27*(1), 57-78.)

The research study of Müller (2011) identified three matured open source ILS namely Evergreen, Koha and PMB. We are going to study these three open source ILSs along with NewGenLib as a special case as it is originated from India.

3.4.1 Evergreen

Evergreen (http://evergreen-ils.org/) is originated from public library domain in 2006 like Koha (released in 2000 as open source ILS). The Evergreen Project was started in 2006 by the Georgia Public Library System to support 275 public libraries in the state of Georgia, US. This Client-Server open source ILS is based on a robust, scalable, message-passing framework – OpenSRF, available under GNU GPL, version 2, and currently used by over 1000 libraries around the world.

It has modules for circulation (with sophisticated fiscal management), cataloging (with comprehensive MARC 21 based catalogue editor), Web catalog, and statistical reporting, acquisition and serials control. It also supports the SIP2 protocol for self-check The current relase is version 2.6 (released in April 2014) and the next release (version 2.7) is due in September 2014. It has comprehensive documentation (http://docs.evergreen-ils.org/), wiki (http://evergreen-ils.org/dokuwiki/doku.php), and feature request facility.

System requirements

Evergreen is based on client-server architecture. It means that at server level we need to install server version of Evergreen and in client machines client version of Evergreen need to be installed and configured. The minimum hardware requirements of server and client machines are as follows:

Server level

- A high-end desktop or entry-level server.
- 1GB RAM, or more (if server runs a graphical desktop).
- Architecture to run Unix-like Operating System (any flavour of Linux).
- Ports 80 and 443 should be opened in for TCP/IP connections to allow OPAC and staff client connections to the Evergreen server.
- Network to establish server-client connections.

Client machines

- Low-end desktop with Windows (XP, Vista, or 7/8), Mac OS X, or Linux operating system.
- A reliable high speed Internet connection.
- 512MB of RAM.
- TCP protocol to connect Evergreeen server at ports 80 and 443.
- Barcode scanner and printer (optional).

Companion software

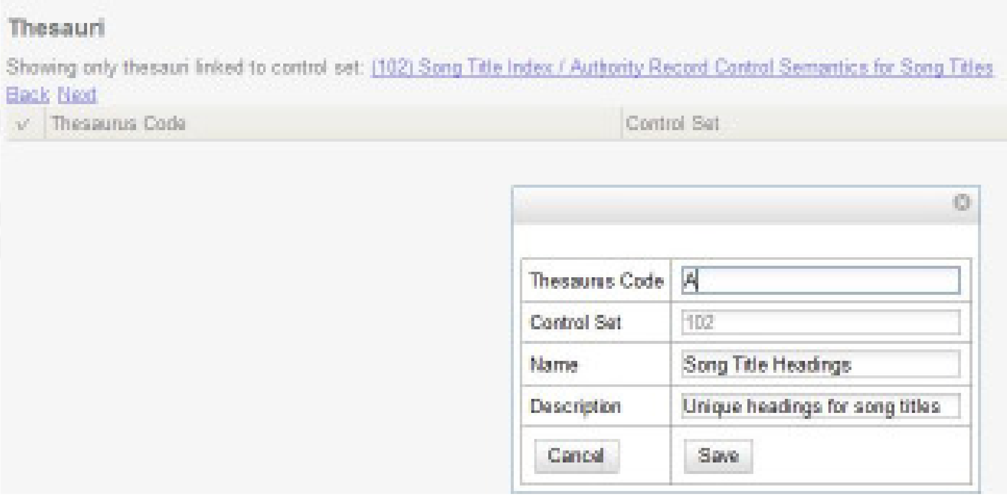
Apart from Evergreen server and client software, the server machine requires following companion software to run server version of Evergreen:

4) Unix-like Operating System.
5) PostGreSQl as RDBMS (version 9 or later).
6) Apache as Web server (version 2.x).
7) OpenSRF (version 2.3.0 or later).
8) libdbi-libdbd libraries.

Major Features

The general features of evergreen ensure stability (even under extreme server load), capability (robust handling of high volume of transactions and concurrent users), flexibility (to accommodate the varied needs of libraries), security (to protect our patrons' privacy and data) and interactivity (to facilitate patron and staff in using the system). Apart from these features, it supports all sorts of core activities like:

- System administration (privilege control, user and group management, cataloguing editor control, log records management, system parameters settings, report generation, granular access control, search enhancing, Z39.50 server and client settings, module administration, SMS gateway management, federated search control, EDI based acquisition control, theme and skin control for fine tuning user interface, data migration, backup and restoration etc.);
- Acquisitions (acquisitions settings, cancel/suspend reasons, claiming, currency types, distribution formulas, EDI (electronic data interchange), exchange rates, fund tags, funding sources, funds management, invoice menus, line item features [alerts appear in a pop-up box when the line item, or any of its copies, are marked as received], providers [vendor/supplier based profile that includes contact information for the provider, holdings information, invoices, and other information.]);
- Cataloguing (comprehensive MARC editor, authority data control, model data entry worksheet, authority lists support, multilingual data entry, integration of external resources, authority control through MARC 21 authority format, thesaurus integration (eleven number of thesauri are available and cataloguer can create new thesauri), creation of browsing categories, record display control, link checker (helps to verify the validity of URLs stored in MARC records), cross-linking of items (facility to link items to multiple bibliographic records), distributed cataloguing through Z39.50 client, bibliographic data export/import, bibliographic search enhancements – supports for advanced search operators);



Thesauri

Showing only thesauri linked to control set: (102) Song Title Index / Authority Record Control Semantics for Song Titles

✓	Thesaurus Code	Control Set

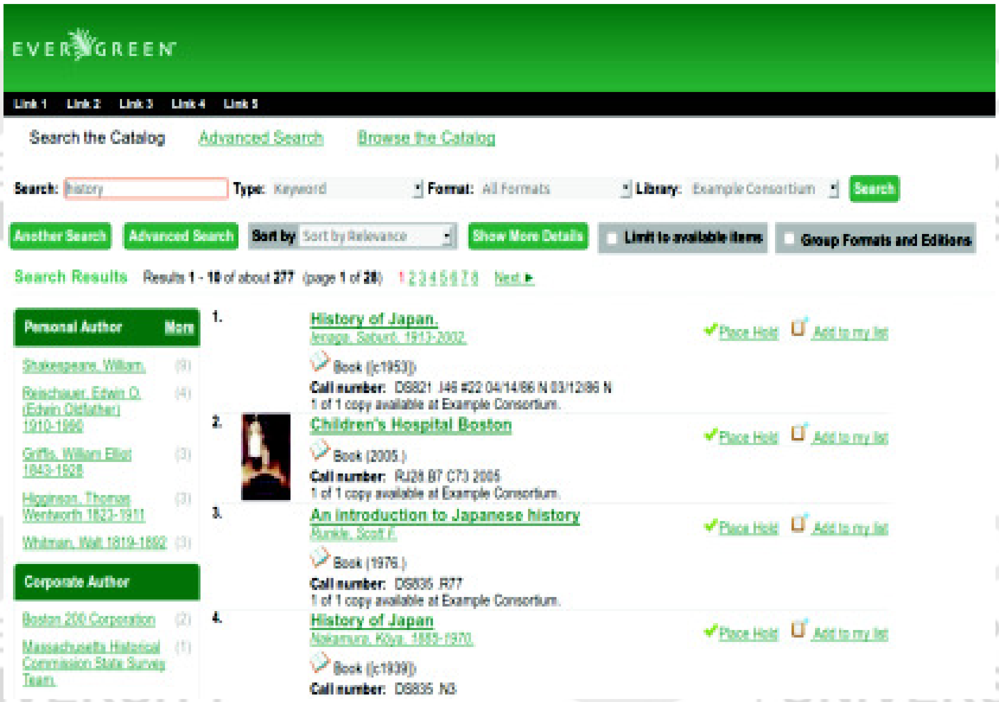
Thesaurus Code	A
Control Set	102
Name	Song Title Headings
Description	Unique headings for song titles

Fig. 3.2: Thesaurus creation in Evergreen

- Circulation (Member management, member data migration, RFID integration, in-built support for bar-coded circulation, smooth issue/return, self-checkout facility through SIP2, circulation parameters settings, a separate facility for holds/reservation management, auto calculation of fines and overdue, SMS alert for overdue materials, facility to manage long overdue, member card generation, off-line circulation etc.);
- Serials control (MARC Format for Holdings Display (MFHD) display in the OPAC, two views of serials control – small number of issues and large number of issues (both views help to create subscriptions, add distributions, define captions, predict future issues, and receive items), loose issue management, holdings management through MFHD, special issues management, template toolkit for OPAC views for serials etc.);

- Report generation (separate report daemon, comprehensive report generation, facility to run recurring reports, reports organisation in folders, facility to select fields for report generation, sorting and filtering facilities, interface to generate report from back-end RDBMS (PostGreSQL), creation of report templates, exporting reports in different formats, report dump feature etc.); and

- OPAC (searching and browsing, availability of sophisticated search operators, separate OPAC for kids, user-driven skin control for OPAC, search results in many formats, including HTML, MARCXML, MODS and binary MARC21 format, facility to store favourite books in "My List:, third party content support (such as reader reviews) in Kids OPAC, user-driven holds/ reservation etc.).



Search: history Type: Keyword Format: All Formats Library: Example Consortium

Sort by Sort by Relevance □ Limit to available items □ Group Formats and Editions

Search Results Results 1 - 10 of about 277 (page 1 of 28) 1 2 3 4 5 6 7 8 Next ▸

Shakespeare, William, (9)
Reischauer, Edwin O. (Edwin Oldfather) 1910-1990 (4)
Griffis, William Elliot 1843-1928 (3)
Higginson, Thomas Wentworth 1823-1911 (3)
Whitman, Walt 1819-1892 (3)

Boston 200 Corporation (2)
Massachusetts Historical Commission State Survey Team. (1)

1. History of Japan.
Ienaga, Saburō, 1913-2002.
Book ([c1953])
Call number: DS821 .I46 #22 04/14/86 N 03/12/86 N
1 of 1 copy available at Example Consortium.

2. Children's Hospital Boston
Book (2005)
Call number: RJ28 B7 C73 2005
1 of 1 copy available at Example Consortium.

3. An introduction to Japanese history
Runkle, Scott F.
Book (1976)
Call number: DS835 .R77
1 of 1 copy available at Example Consortium.

4. History of Japan
Nakamura, Kōya, 1885-1970.
Book ([c1939])
Call number: DS835 .N3

Fig. 3.3: OPAC in Evergreen

Special features

The Evergreen open source ILS originated as ILS for library consortia and has the credit of many special or unique features such as:

- Use of Open SRF (a message routing network that offers scalability and failover support for individual services and entire servers with minimal development and deployment overhead);

- TPAC support to associate a web page with a library (useful to link library information page, library rules, journal portals etc.);

- Auto-suggest option during OPAC searching (the facility may be enabled/ disabled by users);

- OPAC is Web Content Accessibility Guidelines (WCAG) 2.0 compatible to support access by physically challenged users;

- Meta-record search facility to access group formats and editions and for listing multiple constituent records;

- Support for MARC format for holdings display and its integration with OPAC for journal holdings;
- EDI support for acquisition of library materials and SIP2 support for self checkout; and
- Support for template creation by administrator and skin selection by users.

Important URLs

- Downloading (http://evergreen-ils.org/egdownloads/);
- Documentation (http://evergreen-ils.org/eg-documentation/);
- Users list (http://evergreen-ils.org/dokuwiki/doku.php?id=evergreen_libraries);
- Wiki (http://wiki.evergreen-ils.org/doku.php);
- Mailing list (http://evergreen-ils.org/communicate/mailing-lists/);
- Blog (http://evergreen-ils.org/communicate/blog/);
- IRC (http://evergreen-ils.org/communicate/irc/); and
- Book (http://en.flossmanuals.net/_booki/evergreen-in-action/evergreen-in-action.pdf).

Remark

Evergreen open source ILS has improved a lot in recent years and presently considered as the model ILS for managing library consortia and library networks. However, the above mentioned features of Evergreen suggest that the ILS can be deployed in any type or size of individual library to support core automation workflow as well as many value-added features.

3.4.2 Koha

As you know already, there are now almost fourteen open source ILS in the domain of library automation. But Koha is the first open source ILS (released in 2000 as open source) and possibly it is now the most feature rich open source ILS. Koha changed the rule of game in the ILS market and set trends in many ongoing changes in the area of library automation. Koha was originated in public library system of New Zealand. In Maori language Koha means an *unconditional gift*. The first version (1.0) of Koha made available for downloading as open source software in July 2000. The current stable version is 3.14.06 (released in April 30, 2014). The Koha ILS community is very active and in every month the developer community provides a bugfix release. Koha versions with new features are released in every six months (for example the next stable version 3.16 is expected to be released in June 2014). Koha is an integrated library management system that was originally developed by Katipo Communications Limited of Wellington, New Zealand for the Horowhenua Library Trust (HLT), a regional library system located in Levin near Wellington. In 1999, Katipo proposed developing a new system for HLT using open source tools (PERL, MySQL, and Apache) that would run under Linux and use Telnet to communicate with the branches. The software was in production on 3rd January 2000, and released under the GPL for other people to use in July 2000. Koha 1.01 was released on August 9, 2000. Koha is essentially based on LAMP architecture. Here L is Unix-like OS (different flavours of Linux); A is Apache Web server; M is MySQL

RDBMS and P is PERL programming environment. Koha is pioneer in a number of technological achievements such as use of Web 2.0 tools, integration of authority format and bibliographic data format, availability of OPAC interface in 25 different languages, implementation of Z39.50 server and OAI/PMH compatibility, in built support for social networking tools, independent branch management, Web-based self issue, use of open standards for different modules and granular system administration facilities.

System requirements

Koha is based on Web architecture. Both staff interface for professional activities and public access interface for retrieval are available through Web browser. This Web-enabled open source ILS supports 24×7 mode of access for both for staff and users. Another important advantage of the Web architecture is no requirement of installation of client software in the end-user terminals. A web browser (like Firefox, Chrome etc.) may act as client software at end user terminal. This feature of Koha reduces maintenance works to a great extent in a large campus library (for example we need to install, configure and maintenance Koha only at the server; at client level no Koha specific maintenance is required as client machines access Koha through a preloaded Web browser). In short, at server level we need to install Koha and client machines can access Koha server through Web browser (most of desktops and laptops are preloaded with web browser). The minimum hardware requirements of server and client machines are as follows:

Server level

- A high-end desktop or entry-level server
- 1GB RAM, or more (if server runs a graphical desktop)
- Architecture to run Unix-like Operating System (any flavour of Linux but Debian and its derivatives like Ubuntu are mostly in use)
- Ports 80 and 8080 should be opened in for TCP/IP connections to allow OPAC and staff client connections to the Koha server. These two ports are default ports for OPAC and staff interfaces respectively but the ports can be changed as per the network settings of the library
- Network to establish TCP/IP connections.

Client machines

- Low-end desktop with Windows (XP, Vista, or 7/8), Mac OS X, or Linux operating system
- A reliable high speed Internet connection (optional)
- 512 MB of RAM
- TCP/IP protocol to connect Koha server at ports 80 and 8080 (or other ports as desired)
- Barcode scanner and printer (optional).

Companion software

Apart from Koha, the server machine requires following companion software to run server version of Evergreen:

9) Unix-like Operating System (Koha users prefer Debian, Ubuntu and CentOS)

10) MySQL as RDBMS (version 5.5 or later)

11) Apache as Web server (version 2.x)

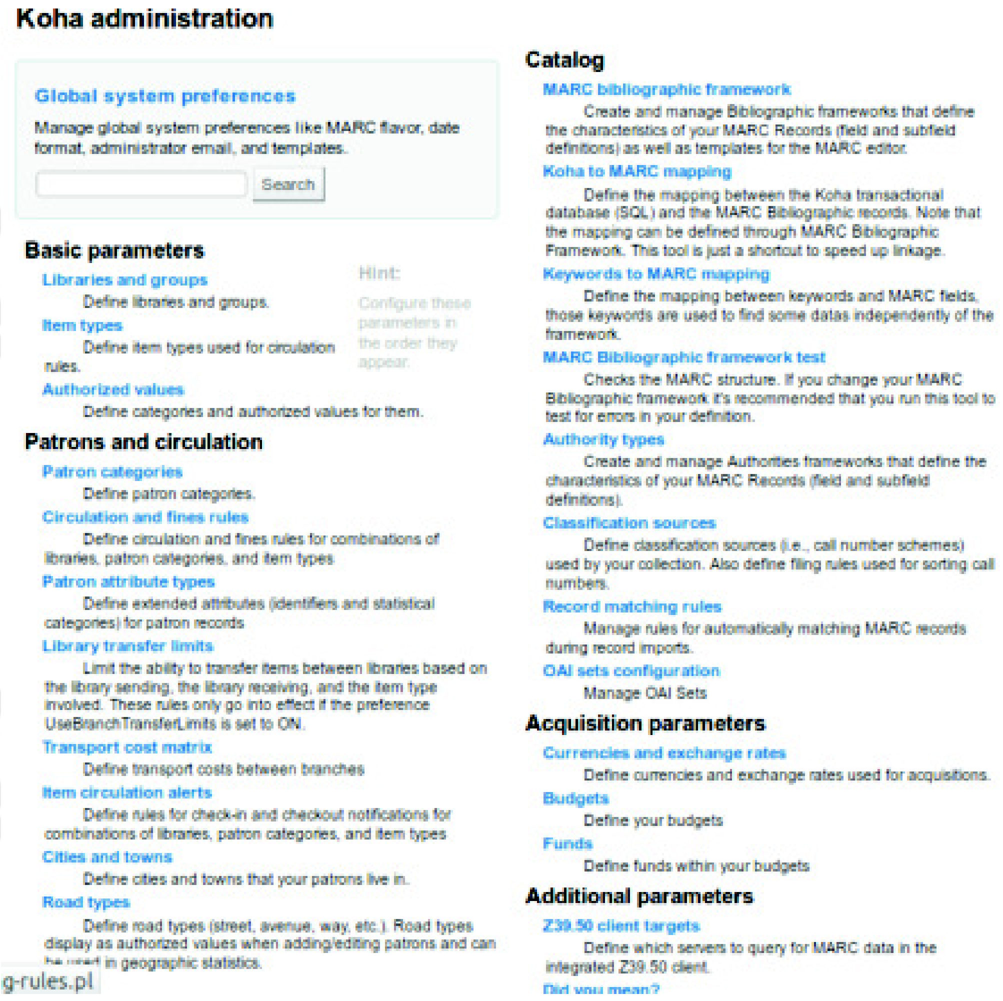
12) YAS toolkit

13) PERL programming environment (version 5.10 or later) and PERL modules (version 3.14 of Koha requires a total of 139 PERL modules).

Major Features

Koha is considered as the first and the best ILS from open source domain. It is a global The Koha developer team explored many emerging possibilities to redefine the scope of ILS such as OAI/PMH server, Z39.50 server, OPAC in 25 languages (the list is growing everyday), options for two text retrieval engines (Sebra and Apache-Solr), and options for two cataloguing interfaces (default cataloguing template and Biblios template). However, the major features are as follows:

- System administration (global parameters settings for each module, basic parameters settings for library, enhanced contents for integrating cataloguing data with global resources through information mashup, comprehensive report generation, granular access control, independent branch management option, log records supervision, fine tuning of privilege control MARC bibliographic framework set, Z39.50 client settings etc.);



Koha administration

Global system preferences

Manage global system preferences like MARC flavor, date format, administrator email, and templates.

Basic parameters

Libraries and groups
Define libraries and groups.

Item types
Define item types used for circulation rules.

Authorized values
Define categories and authorized values for them.

Patrons and circulation

Patron categories
Define patron categories.

Circulation and fines rules
Define circulation and fines rules for combinations of libraries, patron categories, and item types

Patron attribute types
Define extended attributes (identifiers and statistical categories) for patron records

Library transfer limits
Limit the ability to transfer items between libraries based on the library sending, the library receiving, and the item type involved. These rules only go into effect if the preference UseBranchTransferLimits is set to ON.

Transport cost matrix
Define transport costs between branches

Item circulation alerts
Define rules for check-in and checkout notifications for combinations of libraries, patron categories, and item types

Cities and towns
Define cities and towns that your patrons live in.

Road types
Define road types (street, avenue, way, etc.). Road types display as authorized values when adding/editing patrons and can be used in geographic statistics.

Catalog

MARC bibliographic framework
Create and manage Bibliographic frameworks that define the characteristics of your MARC Records (field and subfield definitions) as well as templates for the MARC editor.

Koha to MARC mapping
Define the mapping between the Koha transactional database (SQL) and the MARC Bibliographic records. Note that the mapping can be defined through MARC Bibliographic Framework. This tool is just a shortcut to speed up linkage.

Keywords to MARC mapping
Define the mapping between keywords and MARC fields, those keywords are used to find some datas independently of the framework.

MARC Bibliographic framework test
Checks the MARC structure. If you change your MARC Bibliographic framework it's recommended that you run this tool to test for errors in your definition.

Authority types
Create and manage Authorities frameworks that define the characteristics of your MARC Records (field and subfield definitions).

Classification sources
Define classification sources (i.e., call number schemes) used by your collection. Also define filing rules used for sorting call numbers.

Record matching rules
Manage rules for automatically matching MARC records during record imports.

OAI sets configuration
Manage OAI Sets

Acquisition parameters

Currencies and exchange rates
Define currencies and exchange rates used for acquisitions.

Budgets
Define your budgets

Funds
Define funds within your budgets

Additional parameters

Z39.50 client targets
Define which servers to query for MARC data in the integrated Z39.50 client.

Did you mean?

Fig. 3.4: Koha administration

- Acquisitions (basic parameters for acquisition, budget head and fund allocation, real time fund accounting, vendor management, different types of order handling, order through Z39.50 searching, exclusive data entry framework in acquisition module, provision for item related information etc.);

- Cataloguing (comprehensive MARC editor, inclusion and integration of MARC 21 bibliographic and authority framework, integration of thesaurus and authority lists, multilingual data entry, sub module for authority data management, Z39.50 client search for both bibliographic and authority data, implementation of FRBR model in providing item related information, integration of catalogue data with global related resources through title-ISBN matching rule, help to manage leader, control (00X) and number and code fields (0XX) in MARC 21 etc.);

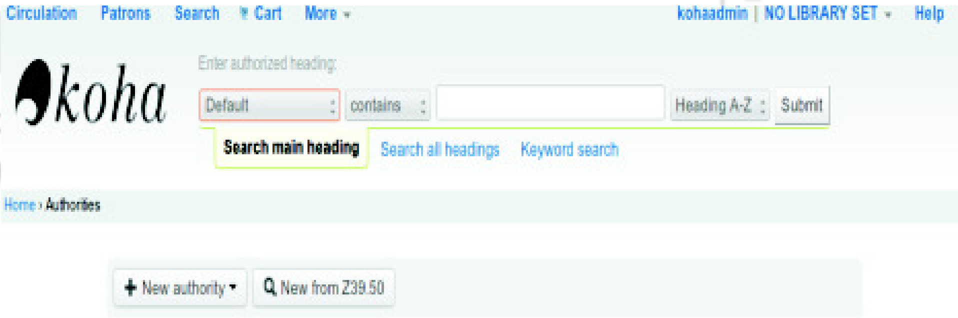


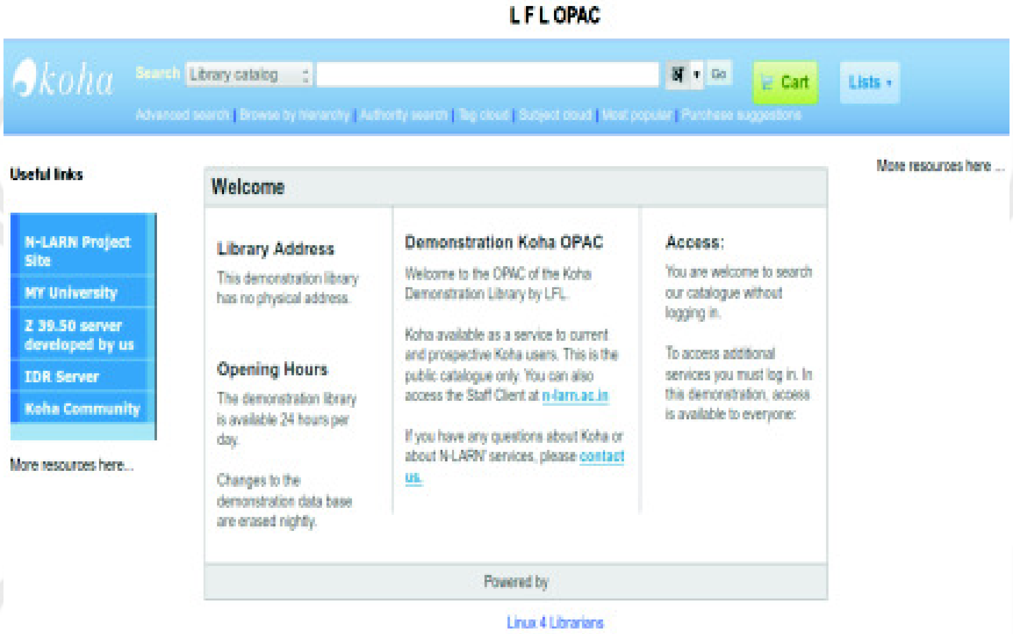
Fig. 3.5: Authority cataloguing in Koha

- Circulation (all required activities support, off-line circulation, granular circulation rules, fine calculation through cron job, RFID integration facility, member photo management, fast cataloguing in circulation module, renew, holds management, user-driven reservation etc.);

- Serials control (predictive mode of serials control, easy management of Kardex of loose issues of journals, holdings management, separate display for back volumes and current issues, provision for routing, easy renewals, creation of frequency master and numbering patterns, vendor-wise claim management, links with cataloguing module and budget head under acquisition module etc.);

- Report generation (predefined reports, custom report format, provision for pick-and-choose fields, auto scheduling of reports, sorting and filtering provision, statistical reports, top lists, format exchange provision); and

- OPAC (searching and browsing, enhanced content integration through information mashup, simple and advanced search interfaces, OPAC language change option, user login for personal information environment, authority searching, tag cloud, subject cloud, purchase suggestion, filter by language, item types and library, different sorting options – title, author, relevance, dates, popularity, call number, range search and sophisticated search operators, cart for listing favourite documents, private and public lists, filtering by subtype – by audience, by content type, by format, and by content type, by availability, purchase suggestions etc.).



Welcome

Library Address

This demonstration library has no physical address.

Opening Hours

The demonstration library is available 24 hours per day.

Changes to the demonstration data base are erased nightly.

Demonstration Koha OPAC

Welcome to the OPAC of the Koha Demonstration Library by LFL.

Koha available as a service to current and prospective Koha users. This is the public catalogue only. You can also access the Staff Client at n-larn.ac.in

If you have any questions about Koha or about N-LARN services, please contact us.

Access:

You are welcome to search our catalogue without logging in.

To access additional services you must log in. In this demonstration, access is available to everyone.

Powered by

Linux 4 Librarians

Fig. 3.6: OPAC in Koha

Special features

The Koha open source ILS originated as ILS has many special or unique features. Some of the important special features are:

Enhanced features

- Can be integrated with free bibliographic data services (XISBN, Amazon, ThingISBN)
- Full authority control
- Compliant fully with Unicode 5.1
- Can be used as CMS (Integration of ILS and CMS)
- Easy control of contents/news/running text
- Can easily be integrated with wiki, blogs etc.
- Supports emerging standards like NCIP, MARC-XML, DCMES, METS
- Supports sophisticated search features – Boolean, Relational and Positional operators
- Any report generation.

Standard supports

- SRU/W, Z39.50, UnAPI (http://unapi.info/) , COinS/OpenURL
- OpenSearch (http://opensearch.a9.com/)
- Records are stored internally in an SGML-like format and can be retrieved in MARCXML, Dublin Core, MODS, RSS, Atom, RDF-DC, SRW-DC, OAI-DC, and EndNote;
- OPAC can be used by citation tools such as Zotero
- Koha 3.x includes support for 3M's Standard Interchange Protocol (SIP2), using the OpenNCIP libraries (http://openncip.org)

- Cross-platform, multi-RDBMS architecture
- News writer, label creator, calendar, OPAC comments, MARC staging and overlay, notices, transaction logs, guided reports with a data dictionary and task scheduler, classification sources/filing rules etc.

Web 2.0 features

- Can generate RSS (including ATOM) feed for search query
- Supports information mashup (OPAC can be linked with book jacket service, book rating/review from Amazon, Google books, Syndicate LibraryThing, Open Library etc.)
- Users can submit comments/rating/tags for any item from any device (mobile OPAC)
- Can be integrated easily with many Web 2.0 tools like zoreto, delicious, etc.

Important URLs

- Downloading (http://koha-community.org/download-koha/);
- Documentation (http://koha-community.org/documentation/);
- Users list (http://wiki.koha-community.org/wiki/Category:Koha_Users)
- Wiki (http://wiki.koha-community.org);
- Mailing list (http://koha-community.org/support/koha-mailing-lists/);
- Free support (http://koha-community.org/support/free-support/);
- IRC (http://koha-community.org/get-involved/irc/); and
- Calendar of events (http://koha-community.org/calendar/).

Remark

Koha has already established itself as a global trend setter in the domain of ILS. Many libraries in India are using Koha ILS such as Delhi Public Library system, Konkan Public Library system etc. There are almost 2500 installations of Koha. The inspiring examples are the National Library of Venesuela (7.5 million volumes), Delhi Public Library (1.4 million volumes), and the United Nations Food and Agriculture Library (1 million volumes). Koha provides mature support for all major library standards including MARC21 (a family of five standards), UNIMARC, Z39.50 (server and client), SRU/SRW, SIP2, OAI/PMH, Unicode etc. Koha presently serves the needs of a wide range of libraries from academic to public and from special and research libraries to corporate libraries.

3.4.3 NewGenLib

NewGenLib or NGL started as commercial ILS in 2005 and made available as open source ILS under GNU GPL in 2008. NewGenLib is the result of collaboration between a charitable trust called Kesavan Institute of Information and Knowledge Management (KIIKM), Hyderabad and Verus Solutions Pvt. Ltd. It is a platform independent ILS that can be installed in both Windows and Unix-like OS. NGL has five functional modules – technical Processing (Cataloging), circulation, acquisitions, serials management and web OPAC including administration for parameters settings and report generation. The features of the ILS are:

- Architectute (completely web based and adheres to International standards, supports web services and allows networking of unlimited number of libraries, database and operating system independent and uses open-source, n-tier, and Java based technologies for scalability, reliability and efficiency);

- Companion software requirements (JAVA SDK as programming environment, PostGreSQl as RDBMS, Apache Ant as Java installer, Lucene and Solr text retrieval engine, Apace Tomcat as web server);

- Standards support (NGL adheres to international standards like MARC21 (bibliographic, authority and holdings formats), ISO 2709, and AACR-2R. Cataloguing database design is based on well proven database design to adhere to MARC and also supports Unicode 4,0 and UTF-16 encoding format, by which it can support all the possible languages);

- Enhanced services (Import of MARC data from sources such as OCLC and freely available web-based resources, Extensive use of setup parameters in configuring the software to suit specific needs, e.g., in management of fines, Multi-user and multiple security levels, Automated email facility integrated into different functions of the software to ensure efficient communication between library and users, vendors, Module-specific querying in all modules);

- Acquisition (Online requests by users, Firm orders, On-approval purchases, Standing orders, Solicited gifts, Unsolicited gifts, Exchange-triggered acquisitions, Web service interfaces to supply sources such as *amazon.com*, Management information reporting to enable better decisions in acquisitions management;

- Cataloguing (supports data-entry using MARC tags, fields, sub-fields, etc., or Simple, label and form based data-entry, Import of MARC records from sources such as OCLC or from free MARC download sites on the web, Access to authority files during data entry and catalogue database searching, Catalogue record attachments enabling access to related data, e.g., multimedia, web-based resources, scanned images, and full text digital documents, Provision of a search engine to search full text documents, Plug-ins for specialised thesauri, Automatic validation etc.);

- Additional utilities (Network functionalities supports sharing of hardware, server and application software between the host and one or more associate libraries. It helps users of branch libraries - To download metadata or the full text of records, where records are available, into their desktops, In acquisition of new publications from the host library, To access their circulation records, To access electronic journals across all the libraries in the network, To improve services to both the end user and the library staff);

- Circulation (apart from traditional functions supports - Setting of a wide range of circulation options, fines, user privileges, etc., needed in different library environments, Rapid charging, discharging, renewal and reservation operations, Built-in traps for delinquent users, reservations, etc., On-the-fly circulation, Interlibrary transactions, Binding management, Management Information Reporting for better management of collection and Assistance in stock verification);

- Serials control (includes facilities like – Integrated management of serials subscriptions, registration, cataloguing and binding, Rapid registration of incoming serials using a kardex-like interface, Batch and on-demand claiming for missing issues, Support for Union catalogues, ?MIS reporting for better serials management); and
- OPAC (supports - Browser-based access to the library's catalogue database, Extensive search, retrieval, display, print, download and formatting options for patrons (Customised, text format (brief), Text format (Full), MARC tagging, ISO 2709, MARC-XML, Dublin core), Patrons can request new additions, access their circulation data, make reservations and go to the web via the OPAC, Patrons can trigger interlibrary loans, interact with library staff via instant messages/email).

Special features

Functional modules are completely web based. Uses Java Web Start™ Technology

- Compliant with international metadata and interoperability standards: MARC-21, MARC-XML, Z39.50, SRU/W, OAI-PMH
- Runs on open source components like Java SE, PostGreSQL
- A high degree of scalability
- OS independent - Windows and Linux flavours available
- Z39.50 Client for distributed searching
- Multilingual supports (Unicode 4.0 complaint, easily extensible to support Indic scripts, storage, processing and retrieval of multilingual data)
- Provision for RFID integration
- Alerting and messaging services integrated into different modules of the ILS
- Templates for generation of form letters and applies XML-based OpenOffice templates
- Scope for extensive cutomisation like other open source ILS
- Supports digital media archiving and Android compatible.

Important URLs

- Downloading (http://www.verussolutions.bis/web/content/download);
- Documentation (http://www.verussolutions.bis/web/content/documentation);
- Users list (http://wiki.koha-community.org/wiki/Category:Koha_Users);
- Help from experts (http://www.verussolutions.bis/web/content/do-you-need-urgent-help-newgenlib-get-expert-help-free-cost);
- Forum (http://www.verussolutions.bis/web/content/forum); and
- Free support (http://www.verussolutions.bis/web/content/get-help-librarians-my-region).

Remark

NGL is the first open source ILS released from India. It is now a matured open source ILS and many libraries are using NGL. It is under continuous development, for example recently NGL Touch developed as a library kiosk application. The features of NGL ILS are quite suitable for Indian libraries for obvious reasons. Both free and paid supports are vailable for this ILS along side discussion forum, blog and documentation services.

3.4.4 PMB

Müller (2011) reported that PMB (PhpMyBibli) is improving rapidly and coming up as a fully featured open source integrated library system. The PMB ILS project was started by François Lemarchand in October 2002, the then Director of the Public Library of Agneaux, France. Presently it is managed by PMB Services, an initiative to support open source software. PMB is Web-enabled ILS and is using XAMP architecture (X – any OS; Apache as Web server, PHP as programming environment and MySQL as RDBMS). It is also using AJAX to support interactive and collaborative framework. This software is easy to install in comapre with other ILSs from open source domain. It supports both Windows and Linux platform with XAMP architecture. This open source ILS is available in four languages interfaces (English, French, Spanish, Italian). The first version was released in the year 2003 and the current version is 4.1 (released in March 2014). PMB, as open source ILS was initially available through GNU GPL licensing but presently it is available against CeCILL free software license. This platform independent open source ILS supports all basic library automation workflow alongside some advanced features like OPAC 2.0 and electronic SDI service.

System requirements

PMB is based on Web architecture. It means that only server version is required to be installed and in client machines Web browsers (like Firefox, Google Chrome, IE etc) may act as client software to access PMB server. The minimum hardware requirements of server and client machines are as follows:

Server level

- A high-end desktop or entry-level server
- 1GB RAM
- Architecture to run Windows or Unix-like Operating System
- Ports 80 should be opened in firewall for TCP/IP connections to access OPAC and staff client of PMB ILS
- Network to establish TCP/IP connections.

Client machines

- Low-end desktop with any operating system
- A reliable high speed Internet connection for enabling AJAX based services
- 256 MB of RAM
- TCP/IP protocol to connect PMB server at ports 80.

Companion software

Apart from Evergreen server and client software, the server machine requires following companion software to run server version of Evergreen:

14) Any Operating System

15) MySQl as RDBMS (version 9 or later)

16) Apache as Web server (version 2.x)

17) PHP programming environment (version 5.x or later).

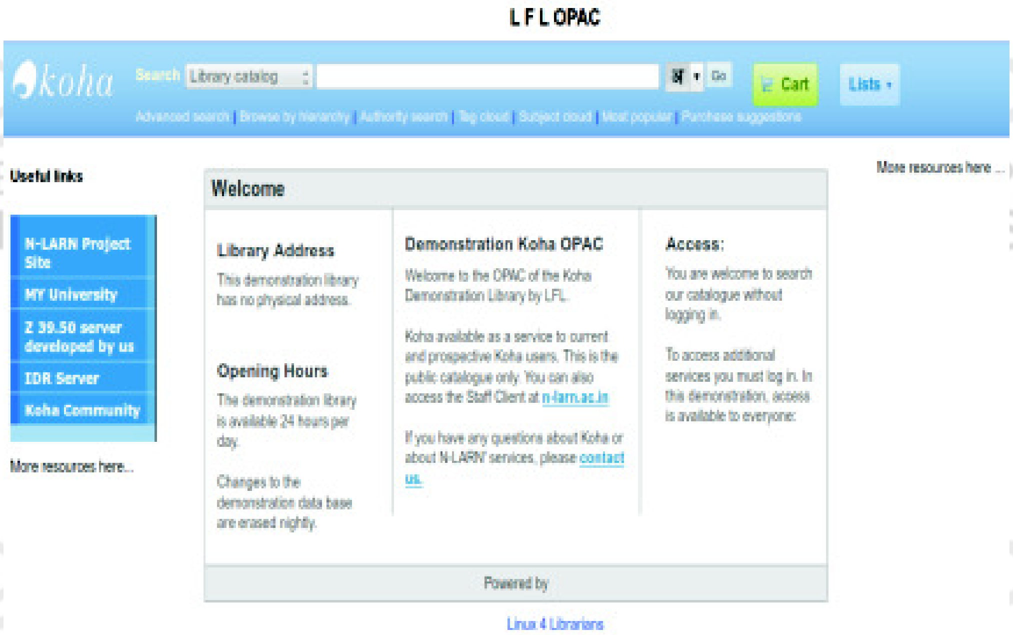
Major Features

Apart from supporting basic activities and automation operations, PMB is supporting authority file management, linking of subject headings with UNESCO thesaurus in cataloguing interface, Web 2.0 features (such as RSS feed, user tagging), SDI service module, facility to search formula (mathematical and chemical formulae), links to search external sources (Amazon, US books etc), shelf management, basic cataloguing of different document forms, on-line help etc. The regular features are as follows:

- System administration (configuration, parameters settings, security, thesaurus linking, SDI setup, external resource management etc.);

- Acquisitions (purchase management – invoice, order, delivery, invoice, payment, accounting etc, budget control, suggestions management, vendor management, budget control etc.);

- Cataloguing (comprehensive UNIMARC editor, authority data control, Z39.50 client search, in built support of UNESCO thesaurus for subject access fields and authority search, predefined data entry format for different document forms, analytical entry etc.);



Library Address

This demonstration library has no physical address.

Opening Hours

The demonstration library is available 24 hours per day.

Changes to the demonstration data base are erased nightly.

Demonstration Koha OPAC

Welcome to the OPAC of the Koha Demonstration Library by LFL.

Koha available as a service to current and prospective Koha users. This is the public catalogue only. You can also access the Staff Client at n-larn.ac.in

If you have any questions about Koha or about N-LARN services, please contact us.

Access:

You are welcome to search our catalogue without logging in.

To access additional services you must log in. In this demonstration, access is available to everyone.

Powered by

Linux 4 Librarians

Fig. 3.7: Cataloguing in PMB

- Circulation (Member management, easy issue/return, calculation of fines and overdue, facility to manage overdue, hold/reservation management etc.);

- Serials control (new serials management, renewals, loose issue management, holdings management, bindings of back volumes etc.);

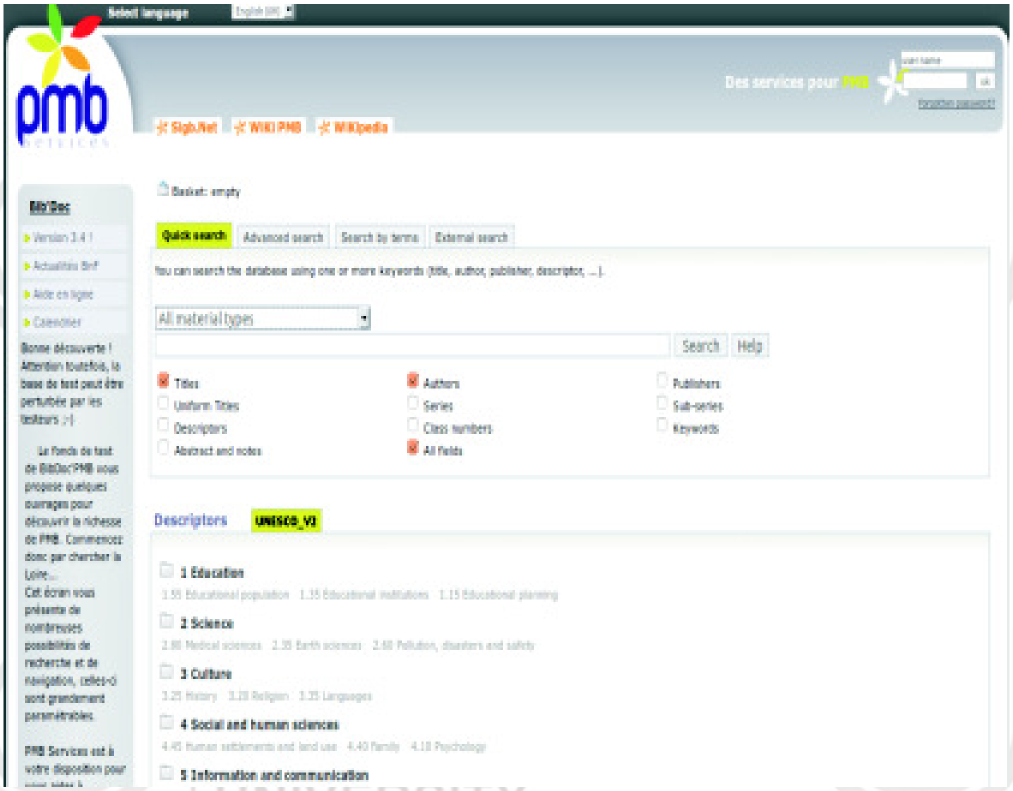
- Report generation (basic reports, statistical reports, report groups – borrower related, document related loan related); and

- OPAC (Web OPAC, basic and advanced searching, linking of UNESCO thesaurus in OPAC, search filter by document types, search filter by fields, all field search option, search for external resources, search help, basic content management utility in OPAC, language selection facility in OPAC etc.).

Special features

The Evergreen open source ILS originated as ILS for library consortia and has the credit of many special or unique features such as:

- OPAC and Staff interfaces in four different languages and facilities to switch over language by selecting target language;
- A module to manage alerting service in SDI mode;
- UNIMARC bibliographic format for different document forms;
- Web-OPAC with Web 2.0 features like RSS, user tagging, book review linking etc.;
- Support for OAI/PMH, FRBR, RDF and RDA;
- E-book management options for different formats including e-Pub;
- RFID integration option; and
- XML based export/import.



Bonne découverte ! Attention toutefois, la base de test peut être perturbée par les testeurs ;-)

Le fonds de test de BibDoc'PMB vous propose quelques ouvrages pour découvrir la richesse de PMB. Commencez donc par chercher la Loire... Cet écran vous présente de nombreuses possibilités de recherche et de navigation, celles-ci sont grandement paramétrables.

PMB Services est à votre disposition pour ...

You can search the database using one or more keywords (title, author, publisher, descriptor, ...).

All material types

☒ Titles ☒ Authors □ Publishers
□ Uniform Titles □ Series □ Sub-series
□ Descriptors □ Class numbers □ Keywords
□ Abstract and notes ☒ All fields

□ 1 Education
1.55 Educational population 1.35 Educational institutions 1.15 Educational planning
□ 2 Science
2.80 Medical sciences 2.35 Earth sciences 2.60 Pollution, disasters and safety
□ 3 Culture
3.25 History 3.20 Religion 3.35 Languages
□ 4 Social and human sciences
4.45 Human settlements and land use 4.40 Family 4.10 Psychology
□ 5 Information and communication

Fig. 3.8: OPAC of PMB

Important URLs

- Downloading (http://forge.sigb.net/redmine/projects/pmb/files);
- Documentation (http://www.sigb.net/index.php?lvl=cmspage&pageid=20);
- User community (http://www.sigb.net/index.php?lvl=cmspage&pageid=18); and

- Technical support (http://www.sigb.net/index.php?lvl=cmspage&pageid=17).

Remark

PMB is quite suitable for small and medium scale libraries. The ease of installation and configuration makes it a suitable candidate for public libraries in India. It can be customised to a great extent to incorporate Indian languages. The only problem of this open source ILS is that the PMB portal is available in French language only and this ILS supports only UNIMARC format.

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

6) Point out the salient features of any one open source ILS known to you.

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7) Make a comparison between any two open source ILSs of your choice.

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3.5 COMMERCIAL SOFTWARE PACKAGES

Most of the large Indian libraries including elite institutes like IITs, IIMs, NITs, IISc, Universities and big college libraries, corporate libraries have adopted commercial ILSs for automating workflows of the libraries. There are two reasons for it – i) most of these institutes started library automation projects in early 1990s when open source ILSs were not available (remember that Koha, the first open source ILS released in July 2000); and ii) the institutes which started automation projects in early 2000 could not rely on open source ILSs because of the lack of on call support. However, situation in India is changing quickly. Many newly established institutes (such as West Bengal University of Technology, Kolkata, MG University, Kerala) are adopting open source ILSs (mainly Koha and NewGenLib) because of the availability/inclusion of features on regular basis, fund savings opportunities, active discussion forum/mailing list/software wiki etc and growing user base of open source ILSs. Some of the large scale libraries like British Council libraries (all centres in India) Indian Statistical Institute, Kolkata switched over from commercial ILS (LibSys) to open source ILS (Koha). This unit already categorised and listed commercial ILSs in sub-section 3.3.1

(see Table 2). There are many commercial ILSs in India that are in use. There is a pattern in adopting ILSs in India. The software LibSys, one of the early initiatives in library automation in India, is utilised by most of the large-scale academic libraries all over India but other commercial ILSs are region specific. For example, SLIM ILS (SLIM 21 and SLIM++) is popular in West India (Maharastra, Gujrat), AutoLib and NIRMALS are popular in South India. As it is not possible to cover all of the commercial ILSs listed in table 2 because of the space limitation, this section discusses only four commercial ILSs on the basis of their huge user base. These are LibSys, SLIM, SOUL and Virtua ILS.

3.5.1 LIBSYS

LibSys (http://www.libsys.co.in/) is an indigenous ILS designed and developed by LibSys Corporation, New Delhi in 1984. LibSys is presently available in six different editions/versions to suite requirements of different types of libraries. These are:

LIBSYS 7: This version of LibSys has features like Unicode Support, Federated Searching, Customisable look and feel, User notification through E-mail and SMS, RSS feeds and integration with Google Books, BookFinder, etc. and interactive features like online reviews, ratings, renewals, reservations etc. The modules are – Acquisition, Cataloguing, Circulation, Serials, Article Indexing, Web OPAC, Customisable Reports. LibSys 7 supports following standards – MARC21, Unicode, SRU/SRW, Z39.50, NCIP (NISO), SICI Barcode.

LSEase: The basic features of this version of LibSys are – independent of Operating System, support for digital media archiving, user-friendly workflow, user-defined security, may be extended to Web architecture.

LSAcademia: It is an ERP Solution to integrate administration of academic institutions and ILS. Apart from library management, it supports Admissions, Student Management, Academic Administration, Examination/ Results, Fee Management, Learning Triggers, Time Table, Student/ Parent Portal, Faculty/ Director Portal, Bus Use, Hostel, Staff Management, Payroll, Alumni etc.

LSmart: It integrates RFID and EM hardware from world renowned manufacturers with LIBSYS and thereby offers following add-on services - RFID Tags on Books/Documents and CD/DVDs, Multiple item processing simultaneously, Self-use Kiosk for check-out/check-in, Book Drops for quick check-in of items, Hand held RFID readers for Shelf Management, EAS Security Gates, Books Sorters to reduce items replacement times on shelves.

LSNet: This version of LibSys evolves around a virtual library that includes the collection of books, CD/DVDs, reference material, etc through a single Web-enabled search interface. It may be integrated with LIBSYS 7 to provide platform for sharing e-content, promotion of library materials, value added services like book updates, reviews, upcoming titles etc.

LSDigital: It is a complete Digital Resource Management System (DRMS) which can be integrated with LIBSYS 7 for value-added digital contents dissemination. The integration provides Implicit interaction with LIBSYS database, Full-text and bibliographic searching through LIBSYS OPAC, Converts different data into format of choice (PDF, Doc, etc.), Define & organises library data structure / flow according to needs and Supports various image manipulations

3.5.2 SLIM

SLIM (System for Library Information Management) a client-server architecture based ILS developed by Algorhythms consultants Pvt. Ltd., Pune (http://slimpp.com). It is a module-based LMS that offers wide range of functionality for library management. Presently there are two versions of SLIM – SLIM 21 and SLIM++.

SLIM 21: The are three levels of SLIM 21 version – Basic Level (Acquisition, Cataloguing, Serials control, Circulation and OPAC); Enterprise Level (Basic Level integrated with Web based OPAC, Selective Dissemination Information (SDI), Inter Library Loan (ILL), Current Awareness Service (CAS), Web Proposals, Statistical Analysis); and L2L Level (Basic level + Enterprise level integrated with Z39.50 client, Z39.50 server, MARC-XML). All of these three levels are supported by additional utilities like Colon classification shelving order, Touch Chip Interface (Biometrics), Newspaper monthly billing, Smart Card / RFID interface, Library Map and News clipping publishing, Multilingual data processing and retrieval, Support for standards like NCIP, SIP2, ISO-2709 etc.

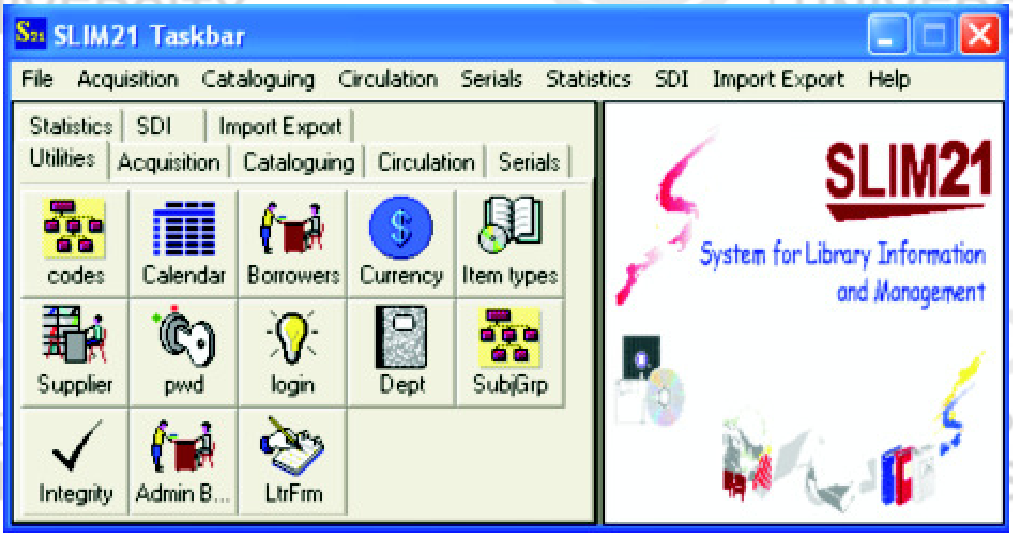

SLIM21 Taskbar
File Acquisition Cataloguing Circulation Serials Statistics SDI Import Export Help
Statistics SDI Import Export
Utilities Acquisition Cataloguing Circulation Serials
codes
Calendar
Borrowers
Currency
Item types
Supplier
pwd
login
Dept
SubjGrp
Integrity
Admin B...
LtrFrm
SLIM21
System for Library Information and Management

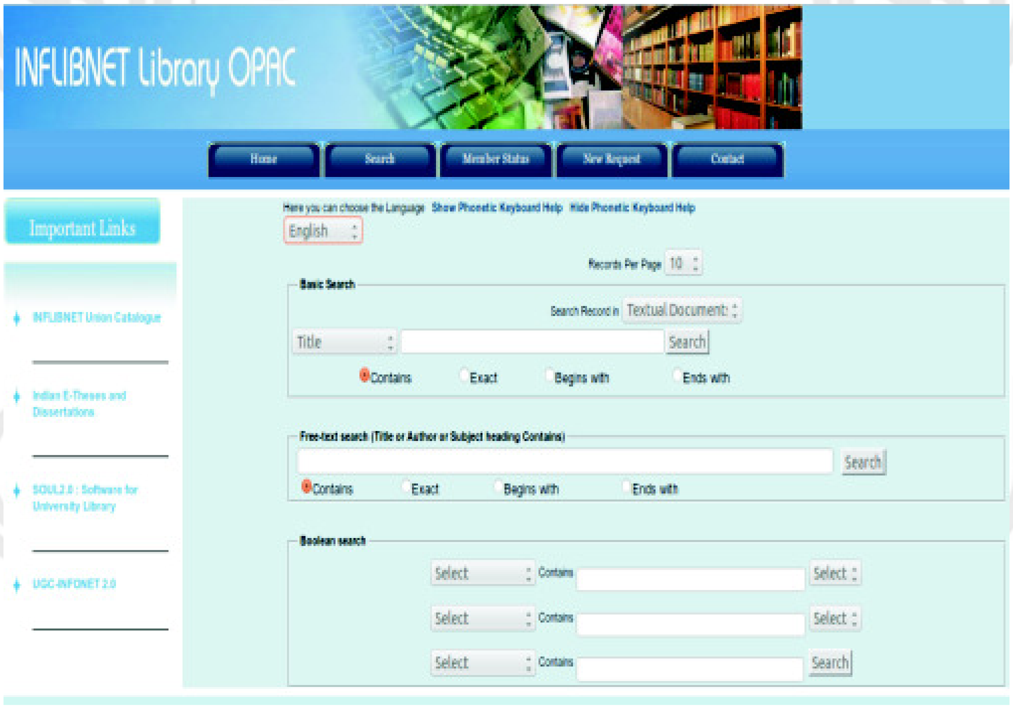
Fig 3.9: SLIM 21 control panel

SLIM ++ is a stripped down version of SLIM 21. It supports export/import through MARC/CCF/ISO-2709 standards and downloading of bibliographic data from online databases through DB Bridge module and Z39.50, generates customised reports on screen/printers/RTF or as text/PDF/HTML files with auto e-mailing facility, supports unicode based LMS that supports multi-script sequencing for Indian scripts, generates shelving order for documents as per colon classification, supports smart card/ RFID based circulation and touch chip (biometric) interface for user authenticity, creates library map for easy location of items and provides user-friendly online help and reference manual.

3.5.3 SOUL

SOUL (http://www.inflibnet.ac.in/soul/) is one of the oldest ILS initiative in India. The story of SOUL (Software for University Libraries) started with the development of ILMS (Integrated Library Management Software) by INFLIBNET in collaboration with DESIDOC. INFLIBNET later decided to develop a state-of-the art, user friendly, Window based system which will contain all the features/

facilities available with other ILSs in the market. As a result, the first version (version 1.0) of SOUL (Software for University Library) released in February 1999 during CALIBER-99 at Nagpur. SOUL uses RDBMS on Windows NT operating system as backend to store & retrieve data. The SOUL has six modules – Acquisition; Cataloguing; Circulation; Serials Control; OPAC and Administration. The modules have further been divided into sub-modules to take care of various functions normally handled by the university libraries. The features of SOUL version 1.0 are: Window based user friendly system with extensive help messages at affordable cost, Client-server architecture based system allowing scalability to users, Uses RDBMS MSSQL to organise data, Multi-user software with no limitation for simultaneous access, User friendly OPAC with web access facility, Supports bibliographic standards like CCF & AACR II and ISO 2709 for export & import facility, Provides facility to create, view & print records in regional languages, Supports LAN & WAN environment and Available in two versions – university library version and college library version. The second version of SOUL, named as SOUL 2.0 was released in January 2009.



English

Records Per Page 10

Search Record in Textual Document

Title

Fig 3.10: SOUL 2.0 OPAC

SOUL 2.0 provides two options for back end DBMS - MS-SQL and MySQL. SOUL 2.0 is compliant to international standards such as MARC 21 bibliographic format, Unicode based Universal Character Sets for multilingual bibliographic records and NCIP 2.0 and SIP 2 based protocols for electronic surveillance and control. MARC-XML as standard for export/import, Supports cataloguing of electronic resources such as e-journals, e-books, virtually any type of material, Supports requirements of digital library and facilitate link to full-text articles and other digital objects, Supports ground-level practical requirements of the libraries such as stock verification, book bank, vigorous maintenance functions, transaction level enhanced security, etc.

3.5.4 Virtua ILS

Virtua ILS (http://www.vtls.com/products/virtua) is a globally reputed ILS product that offers the full spectrum of library activities. This ILS is designed and developed by VTLS Inc., Virginia, US. It uses off-the-Shelf UNIX hardware and the Oracle RDBMS to guarantee continued availability and support. Apart from providing facilities to manage circulation, cataloguing, serials, acquisitions, it also ensures integration with course reserves and managed information environment (integration with student database, institutional repository and so on). All functions are fully integrated, allowing any staff user to access any function at any time according to their library-assigned permissions. The important features of this world-class software are enumerated here in the form of a list.

- System administration (It is fully parameterised software i.e. libraries can configure the setting to achieve maximum flexibility, Basic system includes modules for OPAC, circulation, reserves, cataloguing, acquisition, serials control and reporting,); Provides support for excellent security options at different levels of access, Provides comprehensive customisation parameters (over 1000) for global settings and each subsystem (OPAC, cataloguing, circulation, acquisition, serials control etc, Provides extensive and precise control over user activities and helps creation of rich and customised web interface for various collection components for each patron class;
- Ensures management of multiple libraries or branches across a library);
- Cataloguing (Supports national and international standards for data interchange, Full support for FRBR, FRAD and RDA, Basic system may be supplemented by companion products like RFID, MARC data processing suite, ILL manager and patron self cheek system, Supports multilingual authority control, and networked multimedia database management and seamless access to multiple databases through Z39.50 client, Supports UNICODE and thereby enables the input and display of different languages in their native scripts. In fact Virtua ILS ensures true multi-lingual catalogue database);
- Acquisition (Comprehensive support for all acquisition activities, Integration with institutional financial system, EDI support);
- Additional utilities (Syndetics content enrichment, OverDrive e-books, Comprise PC reservation and print management, iTiva automated telephone notification as well as most self-check and RFID circulation solutions, Allows data exchange with your student information system or financial management system);
- User interface (Helps designing web-enabled digital media archiving and supports development of digital library database (delivery options include CDROM, DLT, DVD and DAT), Provides 'security bit' enabled RFID solution to serve both inventory and theft deterrence functions.

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

8) Point the advantages and disadvantages of using commercial ILSs.

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9) Discuss the features of any commercial ILS known to you.

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3.6 FREEWARE ILSS

Freeware by definition are software that are available free of cost but without the availability of source code. There are some ILSs which are available for downloading and use freely but either they are using companion software which are not open source products (e.g. e-Granthalaya is based on Microsoft products like Windows OS, MSSQL RDBMS and ASP.NET programming environment) or based on non-open source textual database management system (e.g. ABCD and WEBLIS are based on CDS/ISIS). These ILSs are generally used by small-scale libraries like school libraries and rural public libraries. A total of three ILSs are most visible in the freeeware ILS domain. e-Granthalaya in India is developed and supported by a reputed government institute National Informatics Centre (NIC), WEBLIS is now supported by UNESCO and ABCD is the product of BIREME (an organisation based in Brazil that develops and maintains information resources for health science in Latin America and the Caribbean).

ABCD

ABCD (Automation of Libraries and Documentation Centers) is a comprehensive Web-enabled integrated library automation system developed by BIREME, Brazil. It is based on CDS/ISIS as back end databases and WWWISIS as middle-ware. The web interface of CDS/ISIS, called WWWISIS was developed by BIREME in 2005. BIRME in 2010 developed ABCD by using CDS/ISIS as database and WWWISIS as CGI script for designing Web-enabled ILS. It includes all major activities generally expected from a third-generation ILS. Core modules are – Cataloging, Circulation, Acquisitions, Statistics and Reports and OPAC. It also includes a facility called "Adds a Site". This facility is a built-in feature in ABCD to support content management system (CMS). It allows easy production of a library website with integrated meta-search option. In ABCD, cataloguers may use predefined bibliographic formats (like MARC21, UNIMARC, CEPAL) or they may create custom format by using FDT (Field Definition Table) utility of CDS/ISIS. As a whole, ABCD is a very flexible and versatile ILS for use in libraries and information centres where non-standard database-structure create non-bibliographical applications like experts databases, data bank and technology directory. ABCD (present version is 1.0) includes two circulation interfaces – i) standard loans-module; and ii) advanced loans module. The advanced circulation module provides external links with SQL-databases. The upcoming version 2.0 of ABCD will include digital media archiving module. This module will provide facility to handle textual objects and multimedia objects with full-text indexing facilities. The problem of ABCD is that it is not Unicode-compliant (the problem is inherited from CDS/ISIS) and therefore, cannot handle Indic scripts based documents. ABCD is available under GPL (version 3) and independent of

Operating System (bowser based cross-platform system) with standards support like MARC 21, MODS, OAI, XSLT. The programming environments are open source components like Java, JavaScript and PHP. As a whole ABCD is based on an array of technologies like ISIS database, ISIS formatting language, CISIS, ISIS Script, ISIS NBP, Java Script, Groovy and Jetty, PHP, MySQL, Apache and YAS

Resources:

- Technological features (http://reddes.bvsaude.org/projects/abcd/wiki/Features);
- Wiki (http://wiki.bireme.org/en/index.php/ABCD);
- Download (http://bvsmodelo.bvsalud.org/download/abcd/ABCD_1.0_wis_full.exe);
- Project homepage (http://reddes.bvsaude.org/projects/abcd).

e-Granthalaya

e-Granthalaya has improved a lot recently through continuous up-gradation. The current release (version 3.0) supports almost all core activities of an ILS alongside advanced features like e-book management, Web-OPAC, predictive serials control, Unicode-compliant multilingual support, easy data migration and MARC 21 support for both bibliographic and authority data. This ILS is a product of National Informatics Centre (NIC), Department of Electronics & Information Technology, Ministry of Communications and Information Technology, Government of India. The only problem of e-Granthalayas is its dependency on Microsoft products (commercial close source software) like VB.NET or ASP.NET and MSSQL server 2005. The software can be implemented either in stand-alone or in client-server mode. In client-server mode database and WebOPAC are installed on the server PC while the data entry program is installed on client PCs. The version 3.0 of e-Granthalaya supports union catalog output. The major features of this freeware ILS are as follows:

- Technological features (runs on Windows Platform Only (Win XP/vista/7/8/Server 2003/2008) on LAN/WAN environment, UNICODE Compliant, supports data entry in local language);
- Administration (Module - Wise Permission to the software Users, Work-flow as per Indian Libraries and Retro-Conversion as well as Full Cataloguing Modes of Data Entry, Library Statistics Reports);
- Cataloguing (Authority Files/ Master tables for Authors, Publishers, Subjects, etc, Multi-Vol, Multi-Copy and Child-Parent Relationship pattern, Z39.50 Client Search Built-in, Export Records in CSV/Text File/MARC 21/MARC XML/ISO:2709/MS ACCESS/EXCEL formats, Centralised Database for member libraries, Import Data from any structured Source (MARC21/EXCEL), Generate Bibliography in AACR2, Data Entry Statistics Built-In, e-Books management with digital files in pdf or other formats);
- Acquisition (Main/Branch Libraries Acquisition/Cataloguing, Print Accession Register, Bulk accessioning in single click, Budget and account control, Budget Modules with Bill Register Generation, Manages multi-budget heads, Exchange rates, Report generation, Printing accession register etc.);

- Circulation (Issue/return, Membership module, Bar-coding support, comprehensive circulation reports);
- Serials control (Subscription/renewal with auto-generate schedule, CAS/ SDI Services and Documentation Bulletin, Micro-Documents Manger (Articles/Chapter Indexing));
- OPAC and Utilities (Search Module built-in with basic/advance/boolean parameters, Full Text News Clipping Services, Digital media integration with uploading / downloading of pdf/html, etc documents, Web Based OPAC Interface, Photo Gallery available for uploading photo and pictures of the organisations - published on the Library Web site).

Resources

- Portal (http://egranthalaya.nic.in/);
- Forum (https://lsmgr.nic.in/mailman/listinfo/egranthalaya_forum);
- Software request (http://egranthalaya.nic.in/Request%20Form.pdf);
- Documentation (http://egranthalaya.nic.in/eG3_UserManual.pdf).

WEBLIS

WEBLIS stands for Web based Library and Information System. This Web based ILS is based on CDS/ISIS. It has been developed by the Institute for Computer and Information Engineering (ICIE), Poland by combining CDS/ISIS and WWW-ISIS engine (also developed by ICIE). It is freeware ILS and provides basic library workflow support through four modules – Cataloguing system, OPAC (search), LOAN module, Statistical module. WEBLIS is presently supported by UNESCO. The features of these four components of WEBLIS are:

1) Cataloguing system (module is supported by WWW-ISIS data entry facilities and allows management of different document types with support for powerful validation tools, Provision of integrated on-line thesaurus, Availability of model data entry worksheet etc.);

2) Circulation (Issue/return, Hold/reserve management, Auto generation of claiming (by e-mail or a traditional mail in word form), Task schedule, Authorised circulation (through password authentication), Member management, Member management, Loan statistics etc.);

3) OPAC (Simple and advanced search, Search history, Saving queries function, and ISIS Query language facilities, Thesaurus based search support, ISO-2709 based export/import);

4) Statistics (Generate statistical data aggregated from the CDS/ISIS databases, Statistical analysis may be defined in a spreadsheet, Statistical data can be stored in given database).

Resources

- UNESCO Portal (http://portal.unesco.org/ci/en/ev.php-URL_ID=16841& URL_DO=DO_TOPIC&URL_SECTION=201.html);
- Download (http://www.unesco.org/webworld/weblis/Weblis070826.sip);
- Documentation (http://www.unesco.org/webworld/weblis/WEBLIS-DOC.sip);

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

10) What is freeware ILS? List major freeware ILSs.

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11) Discuss the features of e-Granthalaya. What are the problems associated with this ILS?

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3.7 EVALUATION OF SOFTWARE PACKAGES

Evaluation of ILS is an important task for library professional in selecting an ILS for procurement and for migration from one ILS to another. Evaluation criteria must be framed on the basis of factors like: i) type and size of the library system; ii) nature of library services; iii) requirement of technical skills to handle the ILS; iv) use of ILS in neighbouring libraries; v) time needed to perform migration as well as regular maintenance; vi) compliance of ILS with global standards in the domain of library services and interoperability; and vii) fund requirements for capital and recurring expenditure (remember procurement of ILS is not one time capital expenditure, it also involves recurring cost for annual maintenance and regular updation). This section discusses the issues related with ILS evaluation in three heads – generic parameters, specific parameters for commercial ILS and parameters for open source and freeware ILS.

3.7.1 Generic Parameters of Evaluation

Experts differ in clustering the factors or parameters for ILS evaluation. This section attempts to group evaluation parameters into three broad groups – generic parameters, specific parameters for evaluation of commercial ILSs and parameters applicable for open source and freeware ILS. The generic parameters of evaluation for an ILS are applicable to all sorts of ILS irrespective of the origin of these products. The generic parameters (as devised by Mukhopadhyay in 2006) that should be taken into consideration are as follows:

Services availability checklist: An ILS is ranked by the services it provides. Evaluation of a typical third generation ILS should be based on the following core, enhanced and value-added services (Mukhopadhyay, 2006)–

- *Core services*: Acquisition, Cataloguing, Circulation, OPAC, Serials control, Bibliographic format support, Data exchange format support, Article indexing, Retro conversion, Standard report and System administration.

- *Enhanced services*: Customised report generation, GUI based user interface, Reservation facility, Interlibrary loan module, Multi-lingual support, Union catalogue, Authority file support and controlled vocabulary, Online help, Online tutorial, Power search facility, Internet support, Intranet support, Web access OPAC, Multimedia interface, Barcode support and Backup utility.

- *Value-added services*: Patron self service through RFID & Smart card (self circulation, self reservation etc.), Online user training/orientation, Stock verification facility, Members photo ID card generation, Barcode generation, Fine calculation & receipt generation, Gate pass generation, Bulletin board services & e-mail reports, Electronic SDI, CAS support, Digital media archiving support.

Functional checklist: The following general features are part of software module testing, and each functional activity must be tested or conducted during the evaluation process:

- Searching Capabilities (All modules)
- Data Entry and Editing (All modules)
- Bibliographic/item File and Maintenance
- Cataloguing editor (Cataloguing)
- Authority Control (Cataloguing)
- Inventory (Circulation)
- Check-out (Circulation)
- Renewal (Circulation)
- Circulation/Management Reports (Circulation)
- Check-in (Circulation)
- Fines and Fees (Circulation)
- Notice Production (Circulation)
- Holds (Circulation)
- Recalls (Circulation)
- Patron File (Circulation)
- Reserves (Circulation)
- Portable Back-up Units
- Report Writer
- Acquisitions
- Serials
- Electronic Databases
- Gateways
- Network Operations
- Z39.50 Client and Server

- Inter-Library Loan
- Web Accessibility
- Integrated Archiving
- Self Registration
- Statistics Generation
- Export and Import
- Fund Accounting
- Digital media archiving.

Data conversion and backup utility: The ability of the ILS in terms of support for data conversion from other library systems and adherence to the international bibliographic data standards and protocols should be checked extensively. In this age of shared cataloguing systems and web integration, the ILS should also support metadata schemas and interoperability issues like XML, RDF and OAI/PMH. Backup facility in suitable media is also to be checked in view of data recovery at the time of need.

Standards compliance: In Unit 1 (sub-section 1.4.1) of this block, we already discussed the standards that need to be supported by a typical ILS. The minimum essential standards are – ISO–2709 for bibliographic data interoperability; Standard bibliographic formats compliant with ISO - 2709 (e.g. MARC 21, UNIMARC, CCF/B); Z39.50 protocol standard for distributed cataloguing;

Z39.71 standard for holdings statements; BS ISO 9735-9:2002 Electronic data interchange for administration, commerce and transport (EDIFACT); Z39.83-1 (NISO Circulation Interchange Part 1: Protocol (NCIP)); Z39.83-2 (NISO Circulation Interchange Part 2: Protocol (NCIP)); ISO/CD 28560-1(Information and documentation — Data model for use of radio frequency; identifier (RFID) in libraries — Part 1: General requirements and data elements); ISO/CD 28560-2 (Information and documentation — Data model for use of radio frequency; identifier (RFID) in libraries — Part 2: Encoding based on ISO/IEC 15962); ISO/CD 28560-3 (Information and documentation — Data model for use of radio frequency identifier (RFID) in libraries — Part 3: Fixed length encoding); and ISO/IEC 10646: 2003 (Universal Multiple-Octet Character Set or UCS).

The global de facto standards for interoperability that should be supported by an ILS are – MARCXML - MARC 21 data in an XML structure (developed by Library of Congress - http://www.loc.gov/standards/marcxml/) acting as base standard for bibliographic data export/import in place of ISO-2709; MODS (Metadata Object Description Standard) - XML markup for selected metadata from existing MARC 21 records as well as original resource description (developed by Library of Congress – http://www.loc.gov/standards/mods/); MADS (Metadata Authority Description Standard) - XML markup for selected authority data from MARC21 records as well as original authority data (developed by Library of Congress – http://www.loc.gov/standards/mads/); METS (Metadata Encoding & Transmission Standard) - Structure for encoding descriptive, administrative, and structural metadata (developed by Library of Congress -http://www.loc.gov/mets/); PREMIS (Preservation Metadata) - A data dictionary and supporting XML schemas for core preservation metadata needed to support the long-term preservation of digital materials (developed by Library of Congress –

http://www.loc.gov/standards/premis); SRU/SRW (Search and Retrieve URL/ Web Service) - Web services for search and retrieval based on Z39.50 (developed by Library of Congress - semantics http://www.loc.gov/standards/sru/); and OAI/ PMH Version 2.0 - Open Archive Initiative/Protocol for Metadata Harvesting (developed by Open Archive Initiative).

Hardware and third party software requirements: The ILS should provide a complete list of hardware requirements (processor type and RAM) for server and client machines, operating system requirements and back end RDBMS (with version) requirements. Evaluation should be based on total cost for minimum hardware and third party software requirements of the package.

Performance testing: Any ILS should be evaluated by checking some performance testing like transaction throughput capacity and response time, hardware functionality, module functionality, conversion testing, database loading, index building etc.

3.7.2 Specific Parameters of Evaluation for Commercial ILSs

Vendor validity: The reputation of software development group or the vendor is extremely valuable. The following questions should be raised to judge the validity –

- Is the vendor also the software developer, or is the vendor a distributor or agent for the software developer?
- Is there an international presence or is the company localised?
- How long has the software developer been in the library systems industry?
- How long has the library system you are interested in been on the market?
- Who use their products? (Look for someone in close proximity and contact him or her with questions. If possible, make an on-site visit to see the product in action.)

Training, Documentation and Customer support: The vendor must provide:

- o Adequate training facilities without fees for supervisor and operators
  - To manage and operate the system on a day-to-day basic
  - To run file backup operations, software utilities and cataloguing utilities
  - To troubleshoot and solve simple problems and load software enhancement received from the vendor.

- Complete documentation (in hard copy and machine-readable form) must be available with the package along with regular documentation updates and release notes available for local printing or downloading via www including online help for modules and OPAC search.

- The package must have support from the software vendor for hardware and software maintenance, data conversion, emergency and on-call support and disaster management.

3.7.3 Specific Parameters of Evaluation for Freeware and Open Source ILSs

Public Library Association (PLA) working under ALA recommended a set of criteria in selecting open source ILS for library (see http://www.ala.org/pla/tools/technotes/opensourceils). These criteria apart from the general criteria discussed above must be kept in mind in selecting open source ILS. The minimum essential criteria specifically meant for open source ILSs are as follows –

- **Currency and regular releases**: The open source ILS under consideration must have at least two substantial releases a year along with a road map for future development activities.
- **Core modules**: All core activities of a library like acquisition, cataloging, circulation, serials control, systems administration and patron access catalog modules must be available. Value-added services that require to run library operations smoothly (like barcode generation, fine calculation, gate pass printing, member card printing, web-OPAC etc.) must be included in road map of development.
- **Standard Data Formats**: MARC 21 family of standards (at least MARC 21 bibliographic format and Authority format) should be supported alongside export/import facilities (based on ISO-2709/MARC-XML). Availability of UNIMARC format in addition to MARC 21 standards is an added advantage.
- **IPR and Licensing**: Current source code and technical documentation are available for downloading under the GNU General Public License.
- **User base**: The product is currently in use in a significant number of libraries.
- **Scalability**: Scalability should not be an issue; it means there should be no risk of database size or activity levels exceeding the capacity of the software.
- **Developer group**: A dedicated group of developers ensures the progress of open source ILS under consideration such as adopting cutting edge technologies in developing new features and facilities.

Of course, the main OSS ILS in the U.S., Evergreen and Koha, meet all of these criteria. Libraries that have already decided to choose one of these systems will need to consider other factors. The Massachusetts Library Network Cooperative has released a useful list of points comparing these systems (http://masslnc.cwmars.org/node/1892).

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

12) Why do we need a framework for ILS evaluation? Enumerate the factors to be considered in selecting ILS.

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13) What are specific factors to be considered in selecting open source ILS?

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3.8 GLOBAL RECOMMENDATIONS

ILSs are changing fundamentally to meet the challenges of network era and as a direct result of this transformation the difference between automated library system and digital library system is blurring day-by-day. We already covered the role of global recommendations in shaping ILSs and basic recommendations as proposed by ILS-DI and OLE in sub-sections 1.5.1 and 1.5.2 of Unit 1(block 1 of course 9) respectively. Here we are going to study major technical recommendations advocated by these two global agencies.

DLF ILS Discovery Internet Task Group **(ILS-DI)** Technical Recommendations are acting as pathfinders for advancement of ILSs or Library Management Systems (LMSs) globally. These recommendations were developed in 2008 by Digital Library Federation (DLF) to guide inter-operation between integrated library systems and external discovery applications (DLF, 2008). These recommendations are under continuous revision. The major ILS-DI recommendations may be grouped as follows:

General

- Improve discovery and use of library resources via an open-ended variety of external applications that build on the data and services of the ILS;
- Articulate a clear set of expectations;
- Make recommendations applicable to both existing and future systems and technologies;
- Support interoperation and cooperation with applications outside the traditional library domain;
- Ensure that the recommendations will be feasible to implement; and
- Be responsive to the user and developer community.

Interoperability, Functionality and Standard Compatibility

- Basic Discovery Interface (BDI) should support applications that provide discovery outside the ILS;
- BDI should include a broad range of practical discovery tools that operate in tandem with the OPAC;
- BDI may be linked with domain-specific discovery platforms (e.g. courseware repository in case of academic libraries and community information resources in case of public libraries);

- BDI should facilitate metadata harvesting, availability checking for resources (within and outside of library system) and bibliographic request functionality;
- Data aggregation, Real Time search, Patron functionality, and OPAC interaction;
- Compatibility with the established and emerging standards like OAI/PMH, SRU/SRW, METS, MODS, DCMES, MARC-XML, NCIP etc.;
- Facilities to expose bibliographic records to different external discovery tools (such as SOPAC, Vufind, etc.).

Data aggregation

- Many external discovery applications need to maintain external copies of ILS data and thereby supports should be provided for extracting, or harvesting, ILS data (bibliographic, authority, holdings, and other item metadata (such as circulation information) in bulk;
- Facilities must be provided for – selective harvesting for external metadata transformation, cleanup, relationship (FRBRising), vocabulary mapping and other processing services;
- Bibliographic records should be in a well-specified format and each record should have a unique persistent identifier;
- Bibliographic records must be available in interchangeable native format (for example, a MARC record stored as relational table elements could be returned as native marc21, or as MARC-XML schema, or DCMES or MODS and METS; and
- Support for compatibility with different text retrieval engines (for example, a Lucene index of bibliographic records that can be searched with facets using Solr).

Search and retrieval

- Integration of ILS with digital library system or other application requires the capacity to perform rich, real time searches as a mission-critical feature;
- ILS should provide XML-based protocol like SRU/W (SRU and SRW) for distributed search apart from traditional library-centric search protocol like Z39.50;
- Enabling the ILS as a target for meta-searching via a standard federated search product or other discovery tool (with inclusion of features like result paging, sorting, and query filtering);
- Search system should display real time availability of results (both at the bibliographic level and at the item level), rather than availability data;
- Search system should be able to storing, processing and retrieving of Unicode-compliant multilingual documents;
- Full authority records should be available for Real Time Search. Like bibliographic and holdings information, authority information can be expressed using the MARC 21 authority format (http://www.loc.gov/marc/authority/).

Patron Functionality

- Library system should note that patrons use the OPAC for more than just discovery – they also use it to manage their account and request delivery of discovered materials;
- System should ensure patron authentication, patron account retrieval, and circulation/delivery transactions;
- System should support standard protocols like NCIP and SIP2;
- Patrons must be able to retrieve all the personal information (like fine information, hold request information, loan information, messages etc.);
- System must support privilege control facilities to provide selective functionalities to patrons.

User Interaction

- Interface should have provision for adding links to external resources from within the OPAC;
- Availability of federated search mechanism is desirable;
- System should support standard protocols openURL;
- System must support interactive user interface for user-driven tags, comments, reviews and ratings.

The abstract reference model of **OLE project** centres on seven fundamental functions of library systems. The major recommendations are as follows –

Select Entity

This function describes the processes of acquisition of an entity and includes workflow like Obtain Metadata and Create Metadata. The resources may be gifts, approval plan items, firm orders, interlibrary loan requests, reserve requests, remote location requests, publication references, trial databases. Metadata can be obtained (if available) or created for descriptive, holdings (e.g. what is available and being considered for acquisition), authority, financial, or other types. The metadata may be harvested from or deposited by another system.

Acquire Entity

Associated license/registry terms are managed and documented within the system through this function. The workflow includes – selection of entity, assigning supplier/vendor, fund management, determine claiming cycle etc. The invoice process and payment activity may be executed manually or electronically (by using protocols such as: EDIFACT; ANSI X12, XML EDI.).

Describe Entity

This function is associated with description of physical or digital entities (resources, collections, people, organisations, services, events, courses, facilities, finances, relationships, etc.). It includes process to obtain, create, modify, delete, or expose metadata for an entity.

Deliver Entity

This function describes the process where a user submits a request for a service or resource and entity supplied to him/her to satisfy information demand. Entities cover a wide range like physical/digital, returnable/consumable, free/fee based, local/trans-local, and ownership/external.

Manage Entity

This function covers processes that track the life-cycle of an entity including preservation, conservation, evaluation, retention, relocation, duplication, version preference, rights management, binding, repair, reformat, replacement, and withdraw. The workflow includes Preserve/Conserve Resource, Manage Inventory, Configure Metadata, Manage Rights, and Reformat Resource.

OLE recommendations are very promising in developing futuristic ILSs. One example of such application is Kuali ILS, an extensible service-driven library management system. Kuali is an enterprise-ready, community-source software package developed on the basis of OLE recommendations. It manages and provides access not only to items in library collection but also to licensed and local digital contents. Kuali ILS has four major OLE components –

Select and Acquire Module

- This module of Kuali developed on the basis of Open Library Environment (OLE) recommendations and includes Financial, Selection, Acquisitions, Receiving, Payment/Invoicing, Licensing, and Electronic Resource Management (ERM), a component that supports operational processes for demand-driven acquisitions of library resources.

Describe and Manage Module

- This module is based on OLE's user-friendly interface that allows library staff to create and manage core metadata relating to library resources such as bibliographic data, localised holdings, and electronic resources access information.

Deliver Module

- This module covers the interactions between the library, its collection, patrons and discovery systems and provides the basic features/functions to manage patron records, item records, circulation tasks, holds management, fine calculation, NCIP standards compliance with local parameters e.g., patron-related blocks, item-related blocks, loan periods, notice types and notice frequency, etc.

System Integration

- Systems Integration is the link between the three modules: Select and Acquire, Describe & Manage, and Deliver. Kuali uses a common middleware suite called Kuali Rice to achieve service oriented architecture (SOA). The SOA supports interoperability related with identity management, acquisitions/ financial accounting, course and learning management, and student information systems.

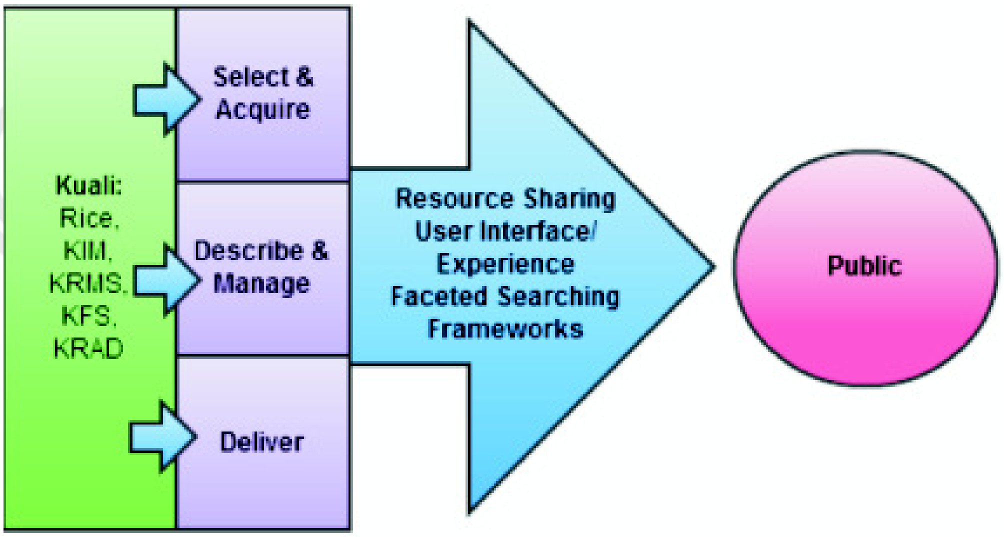

Fig. 3.10: SOA of Kuali ILS based on OLE recommendations

Source: http://www.kuali.org/sites/default/files/ole/system_integration.png

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

14) Draw a summary of OLE recommendations.

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15) Discuss how Kuali ILS is applying OLE recommendations.

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3.9 SUMMARY

This Unit covered ILS available in India in depth. It provided a historical and theoretical foundation of library automation software development spanning last sixty years and under five different generations. Five generations of ILSs against a set of parameters framed in view of the technologies in use and services expected to be available have been compared. After discussing features of different generations of ILS, comparison of ILSs available in India on the basis two trains of characteristics – distribution policy (commercially available ILS, open source ILS and freeware ILS) and place of origin (foreign, Indian and originated in foreign and developed in India) has been done. This Unit discussed features of four most promising open source ILSs, four commercial ILSs (selected on the basis of their user base in India) and three visible freeware ILSs. As evaluating exercise is considered as one of the most important tasks in library automation process, this Unit discussed evaluation parameters under three heads – generic (applicable to all kinds of ILS irrespective of distribution policy and place or origin), specific parameters to be considered for evaluating commercial ILSs and parameters important for evaluating open source ILSs. This Unit ends with a brief discussion on two sets of global recommendations in the domain of library automation namely ILS-DI recommendations and OLE recommendations. It also throws light on the impact of these recommendations in future development of ILS.

3.10 ANSWERS TO SELF CHECK EXERCISES

1) The role of typical library automation software is to manage two major subsystems of a library – operational subsystem and administrative subsystem. Apart from the core activities like acquisition, cataloguing, serials control, circulation and public access interface, an ILS provides many value-added services like online acquisition, FRBRised cataloguing, RFID-enabled circulation, member card printing, bar-coding of accession number and member ID, predictive mode of serials control, interactive OPAC, federated searching, extensive reports and statistics in different formats for supporting decision making process etc.

2) Third and fourth generation ILSs mainly differ in the context of – i) architecture (client-server vs. Web-enabled); ii) database technology (entity-relationship vs. object-oriented); iii) standardisation (bibliographic vs. all round); media support (limited support vs. extensive support); and distribution mode (mainly commercial vs. both commercial and open source).

3) The major features of the fifth generation ILSs are – AJAX support, Support for FRBR, FRAD and FRSAD. Support for Linked Open Data, Use of open interoperability standards, provision of Cloud and Web-scale resource discovery, and Support for federated search.

4) Open source ILSs are available freely under GNU GPL license, extensively customisable (as source codes are available) and based on global open standards in the domain of library automation. The major open source ILSs are Koha, Evergreen, PMB, Avanti, NewGenLib and so on.

5) ILSs available in India may be grouped on the basis of two trains of characteristics – distribution policy (close source and open source) and place of origin (foreign origin, Indian origin and hybrid). as per the distribution policy (conditions for availability of software), software may be grouped into two broad divisions – close source software and open source software (OSS). Close source software therefore, may again be placed in two groups – commercial software and freeware. As per the place of origin, ILSs may be grouped under three fundamental categories – ILSs of foreign origin, ILSs developed over ILSs (or textual database management systems) of foreign origin and ILSs of Indian origin. This grouping may again be sharpened by dividing the packages on the basis of size of library systems

i.e. large library system, medium range library system and small range library system.

6) There are many open source ILSs of which Koha appeared first in the year 2000. It is now considered as the most feature rich open source ILS in the world. The user base of Koha is increasing rapidly all over the world. Many libraries are switching from commercial ILS to Koha because of the following features – i) Web-centric architecture; ii) compliant with all major standards in the domain of library automation; iii) OPAC 2.0; iv) use of open source companion software; v) multi-lingual and Unicode-compliant; vi) supports all core and value-added features expected from fourth generation ILS packages; and vii) OPAC available in 25 languages.

7) A comparative study of Koha and Evergreen may be represented as below:

Koha	**Evergreen**
Web-centric architecture	Client-server architecture
Meant for individual library but may be extended to manage library network or library consortia	Meant for library network or library consortia but may be deployed in individual library
Uses MySQL as back end RDBMS	Uses PostGreSQL as back end RDBMS
Applies PERL modules	Applies OpenSRF

8) The advantages of using a commercial ILS are – i) less responsibility on the part of thelibrarian; ii) on call support service; iii) arrangement of training by vendor; iv) up gradation is responsibility of vendor; v) customisation is fee based vendor activity; and vi) light learning curve.

The disadvantages are – i) no customisation of workflow; ii) non transparent use of standards; iii) huge capital and recurring expenditure; iv) problem in data transfer and migration; v) vendor dependency in every step; and vi) slow release cycle.

9) Virtua ILS, a product of VTLS Inc, US, is one of the most comprehensive ILSs at the global scale. The real advantages of this ILS are – i) compliance with all global standards of library automation, ii) full support for bibliographic data models like FRBD, FRAD, FRASD; iii) provision for RDA based cataloguing along side MARC 21 and AACR 2; v) full support for Web 2.0 architecture to generate interactive user interface; vi) very sophisticated search mechanims; viii) facility to create customise workflow for library and many more such facilities. Virtua ILS is used by many national libraries including National Library of India.

10) Freeware ILSs are available for downloading and use freely but either they are using companion software which are not open source products (e.g. e-Granthalaya is based on Microsoft products like Windows OS, MSSQL RDBMS and ASP.NET programming environment) or based on non-open source textual database management system (e.g. ABCD and WEBLIS are based on CDS/ISIS). The visible freeware ILSs are e-Granthalaya, ABCD and WEBLIS.

11) The current version of e-Granthalaya (version 3.0) is client-server mode integrated library automation package that supports almost all core activities of an ILS along side some value-added services like news clippings, CAS/SDI, article indexing, digital media archiving etc. It also supports many library standards like MARC 21, MARC-XML, ISO-2709 and S39.50 protocol. The main disadvantage of this ILS lies on it's heavy dependency on Microsoft products (Windows OS, MSSQL, VB.NET/ASP.NET) which are not open source software product. As a result a library is getting this freeware ILS at no cost but companion software procurement places huge financial burden on the library budget.

12) A framework for evaluation of ILS is required for three major purposes – i) selection of an ILS for procurement from a short-listed group of ILS; and ii) selection of an ILS for migration from one ILS to another; and iii) development of RFP for seeking expression of interest (EOI). The parameters of selection must be based on following factors –) service availability checklist and standards support checklist; ii) functional features; iii) companion software requirement; iv) hardware support required; v) vendor reputation (in case of commercial ILS), vi) project duration and release cycle (in case of open source ILS); vii) data conversion and transfer support; viii) software architecture; ix) support for cutting edge technologies (like AJAX, Web 2.0, Linked Open Data) and x) support for training, documentation, on-call service (availability of forum, wiki and mailing list in case of open source ILS).

13) The following specific parameters, apart from the generic parameters should be cheeked in selecting an open source ILS – Currency and regular releases, Core modules support, Standard Data Formats, IPR and Licensing, User base, Scalability, and reputaion and duration of Developer group.

14) Open Library Environment project (OLE project - http://oleproject.org) or the OLE project, funded by Andrew W. Mellon Foundation has started in early 2000. As a whole, the OLE project report for future ILSs may be summarised under following heads – 1) Flexibility (Supports for wide range of resources; accessed by a wide range of customers in a variety of contexts); 2) Community ownership (Advocates systems that are designed, built, owned, and governed by and for the library community on an open source licensing basis); 3) Service Orientation (Prescribes technology-neutral service-oriented framework that ensures the interoperability of library systems); 4) Enterprise-Level Integration (Facilitates integration with other enterprise systems such as research support, student information, human resources, identity management, fiscal control, and repository and content management); 5) Efficiency (Provides a modular application infrastructure that integrates with new and existing academic and research technologies); and 6) Sustainability (Creates a reliable and robust framework to identify, document, innovate, develop, maintain, and review the software necessary to further the operation and mission of libraries).

15) Kuali – Open Library Environment or simply Kuali-OLE is an experimental ILS, developed by Kuali Foundation Inc and funded by Andrew W. Mellon Foundation right from January 2010, to achieve the goals of OLE project. The final product is due in late 2014. It is based on six fundamental criteria

as set by OLE project for future ILSs. It is trying to implement following OLE features in the ILS product – Built, owned, governed by the academic andresearch library community; Supports a wide range of resources and formats of scholarly information; Interoperates and integrates with other enterprise and network-based systems, Supports federation across projects, partners, consortia, and institutions, Provides workflow design and management capabilities and Offers information management capabilities to non- library efforts.

3.11 KEYWORDS

Bibliographic metadata : Information about a resource that serves the purpose of discovery, identification and selection of the resource. Includes elements such as title, author, subjects, etc.

EDI : Electronic Data Interchange (EDI) is a standard method for exchanging structured data, such as purchase orders and invoices, between computers to enable automated transactions.

EDIFACT : EDI For Administrations, Commerce and Transport The concept of utilising a single set of specifications for bibliographic records regardless of the type of material they represent.

ERMS : Electronic Resources Management System is used to manage a library's electronic resources, primarily e-journals and databases. Systems can include features to track trials, license terms and conditions, usage, cost, and access.

Evergreen : The first open source ILS designed to handle the processing of geographically dispersed, resource-sharing library networks and library consortia.

GPL : The GNU General Public License is an open source license that is used by Evergreen and Koha.

ILS : An automated library system that utilises shared data and files to provide interoperability of multiple library functions, e.g. cataloging, acquisition, circulation, serials, etc.

Interoperability : The ability for two different computer systems to communicate and exchange information in a useful and meaningful manner.

MARCXML : A metadata scheme for working with MARC data in a XML environment.

Metadata : Structured information that describes an information resource. "Data about data" for an information bearing object for purposes of description, administration, legal requirements, technical functionality, use and usage, and preservation.

Metadata harvesting : A technique for extraction of metadata from individual repositories for collection into a central catalog.

Module of ILS : Functions specific to a particular system capability such as the online public access catalog, cataloging, acquisitions, serials, circulation, etc.

NCIP : NISO Circulation Interchange Protocol (NCIP) is a standard which defines a protocol for the exchange of messages between and among computer-based application to enable them to perform functions necessary to lend and borrow items, to provide controlled access to electronic resources, and to facilitate co-operative management of these functions.

Open Source : A concept through which programming code is made available through a license that supports the users freely copying the code, making changes it, and sharing the results. Changes are typically submitted to a group managing the open source product for possible incorporation into the official version. Development and support is handled cooperatively by a group of distributed programmers, usually on a volunteer basis.

OpenSRF : Open Service Request Framework is developed by Evergreen ILS team to achieve load balancing and service availability.

SIP2 : Standard Interface Protocol Version 2 is a standard for the exchange of circulation data and transactions between different systems.

SOA : Service-Oriented Architecture (SOA) is a software framework for managing loosely-coupled, distributed services which communicate and interoperate via agreed standards.

SRU : Search/Retrieve via URL is a standard search protocol for Internet search queries, utilising CQL (Common Query Language), standard query syntax for representing queries.

SRW : Search/Retrieve Webservice is web services implementation of the Z39.50 protocol that specifies a client/server-based protocol for searching and retrieving information from remote databases.

Unicode : A universal character-encoding standard used for representation of text for computer processing. Unicode provides a unique numeric code (a code point) for every character, no matter what the platform, no matter what the program, no matter what the language. The standard was developed by the Unicode Consortium in 1999.

Z39.50 : A NISO and ISO standard protocol that specifies a client/server-based protocol for cross-system searching and retrieving information from remote databases. It specifies procedures and structures for a client system to search a database provided by a server.

Zebra : A high performance open source text retrieval engine for indexing and retrieval, used by Koha as its primary search system for bibliographic and authority data.

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UNIT 4 LIBRARY AUTOMATION: APPLICATIONS OF OPEN SOURCE SOFTWARE

Structure

4.0 OBJECTIVES

After going through this Unit, you will be able to:

- know what is open source movement and how is it improving computing infrastructure;
- understand differences between commercial and open source software;
- identify advantages of using open source software and open standards in library system; and
- understand the emerging concept of open library system.

4.1 INTRODUCTION

Present library services are software-centric. As per the availability and distribution policy, software products are divided into two groups – closed source commercial products and open source free to use products. Commercial software in the domain of library activities are available against huge license fees along with separate annual maintenance contracts, updating fees and many other hidden costs. As a result, adaptation of a commercial LMS in library (for example) is not one-time capital expenditure but it leads to considerable recurring expenditure on already strained library budget. Moreover, these commercial LMSs are basically available in a generic or fit-to-all size model and provide no scope for customisation to suite the need of a particular library (Mukhopadhyay, 2008). This is an alarming situation for libraries in India. Libraries are paying huge sum of money to procure commercial LMS but unfortunately not in a position to even change the colour of the user interface. Another serious lacuna is the non-transparent nature of these software in the use of global *de jury* or *de facto* standards.

Application of open source software in different library activities may be a viable alternative solution to get rid of the problems related with the application of commercial software. The tradition of open source software started with the advent of ARPANET (now Internet) in 1969 and boosted with the development of open source operating systems like GNU Linux. Naturally, one question is coming to your mind – what is open source software and how is it different. According to OSI (Open Source Initiative, 2003) – "*Open source promotes software reliability and quality by supporting independent peer review and rapid evaluation of source code. To be certified as open source, the license of a program must guarantee the right to read, redistribute, modify, and use it freely*". Open source software are available freely to end users. Here the term *Free* has dual meaning – users are given *freedom* to customise the source code and these software are available *free of cost*. An open source software is attached with four freedoms – read (source code is available for verification), use (binary code is available for application), modify (source code is available for modification and customisation), redistribute (source code in original or in modified form is available for redistribution).

In the area of library services, the greatest benefit of open source software is the opportunity for library professionals to work at the system level and to participate in software development process as co-developers. Fortunately, the domain of library and information science, right from the beginning of the open source movement, is benefited through structured effort and software philanthropy. We have matured ILS like Koha (comparable to any global ILS) from HLT, New Zealand, comprehensive digital library software like DSpace from the MIT, US (with support from HP), Greenstone Digital Library Software (or GSDL) from University of Waikato (presently supported by UNESCO). Apart from these very popular open source software, the arena is presently fielded with an array of promising software like MARCEdit and ISISMARC (MARC cataloguing tools), WEBLIS (ILS based on CDS/ISIS), YAS toolkit (Z39.50 client and server), Lucene and Solr (Text retrieval engines), Unicode-compliant multilingual tools etc. Most of these open source software in the domain of LIS are very transparent in the use of standards and generally deploy open standards for achieving interoperability.

This brief introduction gives you idea on open source software and the possibilities for applications of open source software in enhancing library systems and services. Now we are all set to discuss open source software in depth. The discussion mainly cover six areas – 1) history, development, features and advantages of open source; 2) philosophy, principles and IPR issues related with open source; 3) use and advantages of open source software in libraries in general; 4) application of open source software in library activities at the system level; 5) application of open source software in library activities at the domain level; and 6) the emerging concept of open library systems that manages open contents and supported by open standards and open source software.

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

1) Enumerate the problems for application of commercial software in libraries.

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2) What do you mean by open source? Enumerate the freedoms associated with open source.

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3) List a few open source software in the domain of library services.

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4.2 OPEN SOURCE MOVEMENT

This section covers systematically the definition, scope and origin of open source software including the fundamental differences between open source and close source software.

4.2.1 Open Source Software

Open Source Software (OSS) is not a new idea. You already know that the open source movement started with the Internet. Recently, technical and market forces joined together to draw a niche role of open source movement. Open source movement has all the potentials to define computing infrastructure of the next century (Marco & Lister, 1987). Open source is a software development model as well as a software distribution model. OSS development follows Linus Torvalds's (Linus Torvalds is the developer of Linux operating system – an open source system software) style of development – *release early and often, delegate everything and be open to the point of promiscuity*. Raymond (2001a; 2001b) termed this type of software development as bazaar style of development in comparison with traditional software development process (termed by Raymond as cathedral model), which is carefully crafted by individual wizards or small group of experts working in splendid isolation. The Open Source Initiative (2004), a forum to promote open source software movement as a viable alternative to commercial software claims –

> *"This rapid evolutionary process produces better software than the traditional closed model, in which only a very few programmers can see the source and everybody else must blindly use an opaque block of bits."*

OSS is also considerably different from shareware, public-domain software, freeware, or software viewers and readers that are made freely available without access to source code. Shareware, whether or not one registers it and pays the registration fee, typically provides no access to the original source code. Unlike freeware and public domain software, OSS is copyrighted and distributed with license terms designed to ensure that the source code will always be available. Sometimes small amount of fee may be charged for the software's packaging, distribution, or support.

Definition

The open source movement has been in conscious development for nearly two decades but the term "open source" itself has been a relative latecomer. Christine Peterson of the Foresight Institute proposed the term *open source* in late 1997 during a meeting of small group of open source movement key persons (Raymond, 2001c). This group registered the domain name *opensource.org*, defined "open source," developed Open Source Initiative (OSI) group, designed OSI certification, and created a list of licenses that meet the standards for open source certification. In the open source software development model the source code of software is made freely available along with the binary version so that anyone can see, change, and distribute it subject to the condition he/she abide by the accompanying license. According to OSI (Open Source Initiative, 2003a) –

> *"Open source promotes software reliability and quality by supporting independent peer review and rapid evaluation of source code. To be certified as open source, the license of a program must guarantee the right to read, redistribute, modify, and use it freely*".

Analysis of definitions given by Chudnov (1999), Raymond (1996), Moody (2001), and Morgan (2002), identifies following attributes of OSS –

- OSS is typically created and maintained by developers crossing institutional and national boundaries, collaborating by using Internet based communications and development tools;
- OSS development process follows the famous Linus's law – "Release early, release often and listen to users";
- Quality, not profit, drives open source developers who take personal pride in seeing their working solutions adopted; and
- Intellectual property rights to open source software belong to anyone who helps to build it or simply use it and is not locked to any single vendor or institutions.

4.2.2 Open Source Software: Development Path

Computing community started realising the advantages of sharing of source codes in the late 1970s by using Internet as platform. Early 1980s witnessed a big conflict between OSS and proprietary software. For example, MIT Artificial Intelligence Lab established an agency called Symbolics in early 1980s and made all the freely available software proprietary under its name. This conversion process eventually killed the culture of code-sharing at MIT Lab. This destruction is important in the history of OSS because it initiated the free software movement through the formation of Free Software Foundation (FSF). Richard Stallman, one of the MIT lab members at the time, started The GNU (recursive acronym for GNU is Not Unix) project (a free operating system) in January 1984 and established FSF in 1985 to promote Free Software and the GNU project. The next big contribution in free software movement came from a student in 1991. Linus Torvalds, who at the time was a second year graduate student at the University of Helsinki, wrote a Unix-like kernel (Kernel is core part of operating system) and named it as Linux. He distributed Linux widely, considered users as co-developers and improved it considerably in a short span of time. Linux kernel soon adapted to become the core of the GNU/Linux operating system and many other parallel projects (like BIND, Perl etc.) merged with it. In 1997 GNU/Linux became the bussword in computing community because within 5 years it owned 25 per cent of the server market and growing at the rate of 25 per cent per annum. It's now clear that the code sharing and free software culture has been in conscious development for nearly three decades since the beginning of Internet. But the term "open source" has been a relative latecomer. Christine Peterson of the Foresight Institute proposed the term *open source* in late 1997 during a meeting of small group of open source movement key persons (Raymond, 2001a). This group registered the domain name *opensource.org*, defined "open source," developed Open Source Initiative (OSI) group, designed OSI certification, and created a list of licenses that meet the standards for open source certification.

4.2.3 Open Source Software vs. Commercial Software

The whole array of software can be grouped into two fundamental categories – system software and application software. System software (such as operating system) is responsible for the overall management of computer resources whereas application software are designed to perform certain tasks and thereby make computers able to perform different predefined jobs. This division is based on the application domain of software. As per the distribution policy, software may be grouped into two broad divisions – close source software and open source software (OSS). Open source software is also known as Free/Open Source Software (FOSS) or Free/Libre Open Source Software (FLOSS). Close source software may again be placed in two groups – commercial software and freeware. So, as per the distribution policy (as mentioned in the beginning), the whole array of software may be categorised into three groups – Commercial software, Freeware, and Open source software.

Table 4.1: Software as per the distribution policy

Commercial software	**Freeware**	**Open source software**
Only binary code is available against fees	Only binary code is available at no cost	Both source code and binary codes are available at no cost
As source code is not available, customisation is not possible	As source code is not available, customisation is not possible	As source code is available, extensive customisation is possible and allowed
License agreement allows only the use of software for a definite period and it is mandatory	License agreement allows to use for indefinite period and it is optional	License agreement allows to use, change, modify and distribution of software for indefinite period and it is mandatory

You can easily understand from table 4.1 that the fundamental difference is the opportunity for customisation. Open source also provides freedom to redistribute the customised version of the software.

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

4) Explain the term "open source"?

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5) Write a brief history of open source movement.

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6) Differentiate Close source, Freeware and Open source.

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4.3 OPEN SOURCE SOFTWARE: PHILOSOPHY, PRINCIPLES AND LICENSING

You already know from the previous section what open source is and how is it different from other software distribution including a brief history of open source movement. In this section we are going to study philosophies and principles of open source software, IPR issues related with open source and application of open standards in open source software development.

4.3.1 Philosophy of Open Source Software

Open source software world is dominated by two major philosophies namely the Free Software Foundation (FSF) philosophy and the Open Source Initiative (OSI) philosophy. The philosophy of FSF centres around four user-driven freedoms –

- the freedom to run a program, for any lawful purpose;
- the freedom to study how a program works and adjust it to specific needs (obviously access to the source code is a precondition for this);
- the freedom to redistribute software; and
- the freedom to improve a program and distribute modified program (again access to the source code is a prerequisite for this).

Therefore, we may say that Freedom is at the core of FSF philosophy – the freedom to use, study and customise, the freedom to redistribute, the freedom to cooperate. FSF philosophy is against to software patents and additional restrictions as included in existing copyright laws. On the other hand, the OSI philosophy is slightly different from FSF philosophy. The philosophy of OSI gives less emphasis on the ethical issues as proposed by FSF and is directed towards the practical rewards of the distributed development process of open source software. It targets on the technical values of participatory software development model for developing software, and is more business-friendly than the FSF. But there are many common issues in these two philosophies of open source software development such as efforts against proliferation of commercial software, software patenting and efforts in making software development process easy and user friendly. Richard Stallman, the father of FSF, rightly said that the Free Software Movement and the Open Source Movement are two political parties in the same community (Wong and Sayo, 2004).

4.3.2 Principles of Open Source Software

Development of open source software is governed by ten principles. OSI proposed a set of ten criteria (Open Source Initiative, 2006) for a software product to be called open source software. OSI provides *OSI Certified License* to a software product if it satisfies following ten criteria (popularly known as *Ten Commandments* of open source):

- **Free redistribution**: The license must allow end users to redistribute the software, even as part of a larger software package and may not charge royalties for this right.
- **Source code**: The distribution must make the source code freely available to developers.

- **Derived works**: The license must allow modifications and derived works and must allow them to be distributed under the same terms as the license of the original software.

- **Integrity of the author's source cod**e: The license may require that modified distributions be renamed, or that modifications be made via patch files rather than modifying the source code.

- **No discrimination against persons or groups**: The license must not discriminate against any person or group of persons.

- **No discrimination against fields of endeavour**: The license must not restrict anyone from making use of the program in a specific field of endeavour.

- **Distribution of license**: The rights attached to the program must apply to all to whom the program is redistributed without the need for execution of an additional license by those parties.

- **License must not be specific to a product**: A program may be extracted from a larger distribution and used under the same license.

- **The license must not restrict other software**: The license must not contaminate other software by placing restrictions on any software distributed along with the licensed software.

- **The license must be technology-neutral**: The license should not be framed on the basis of any individual technology or style of interface.

4.3.3 Licensing of Open Source Software

Licensing issues related with open source software are complex in nature. Open source software may be released under a variety of different licenses. Open Source Initiative (OSI) reported availability of more than 60 licenses and categorised these licenses under eight categories (http://www.opensource.org/licenses/index.html). However, an in-depth analysis shows that there are only two primary types of licenses and countless variants are based on these two widely adopted licenses. These two main licenses are the GNU (recursive acronym for GNU's not Unix) General Public License (GPL) and the BSD-style licenses.

The GNU General Public License (GPL)

The key features of GPL are – i) user freedoms is ensured and protected; ii) source code is always available; iii) users are allowed to copy, distribute and modify original code; iv) any changes made to a GPL program by the distributor must also be licensed under the GPL; v) distributors may not place any non-GPL restrictions upon the users; vi) recipients of GPL software are granted the same rights as the original distributor; and vii) a commercial software company cannot take a GPL program, modify it and then sell it under a different, proprietary license.

BSD-style Licenses

BSD-style (Berkeley System Distribution) licenses are identical to the original license issued by the University of California, Berkeley. These are among the most permissive licenses and include key features like – i) attribution is given to the original license holder by including the original copyright notice in source code files; ii) no attempt is made to sue or hold the original licensor liable for damages; iii) software code available under BSD-style license can easily be incorporated into commercial applications; and iv) BSD-style licenses do not require the distribution of source code (after modification of original code). These two major licenses may be compared against the following features in the context of distributing open source software –

	GPL Licensed	**BSD Licensed**
Must distribute original source code	Yes	No
Must distribute user-created source code	Yes	No
User-created source code must be available under GPL	Yes	No
Proprietary Software linking possible	No	Yes
Compatible with GNU GPL	Yes	No*

*The original BSD license is not GPL compatible but the modified BSD license is compatible with GPL.

4.3.4 Open Source and Open Standards

Library services have long depended on shared standards. Recently, one question has been attracting our attention: whether a specific standard is of an open or a proprietary in nature. A proprietary standard is characterised by the fact that it is owned by someone (individual or organisation) who puts restrictions on - or can put restrictions on - users' access and use. On the other hand, a completely open standard has the following properties:

- It is accessible and free of charge to all (i.e. there is no inequity between users, and no payment or other considerations are required as a clause of use of the standard);
- It remains accessible (i.e. owners will not limit access to the standard later on i.e. afterwards); and
- All aspects of the standard are translucent, well documented, and freely available.

The W3C (2006) provides a set of six pack criteria in defining Open Standards:

- transparency (due process is public, and all technical discussions, meeting minutes, are archived and citable in decision making);
- relevance (new standardisation is started upon due analysis of the market needs, including requirements phase, e.g. accessibility, multilinguism);
- openness (anybody can participate, and everybody does: industry, individual, public, government bodies, academia, on a worldwide scale);
- impartiality and consensus (guaranteed fairness by the process and the neutral hosting of the W3C organisation, with equal weight for each participant);
- availability (free access to the standard text, both during development and at final stage, translations, and clear IPR rules for implementation, allowing open source development in the case of Web technologies); and
- maintenance (ongoing process for testing, errata, revision, permanent access).

Software development, as a process, depends on standards (de jury/de facto or proprietary/open) in each step. Open standards provide following advantages – 1) free to apply for any lawful purposes; 2) open and collaborative process of development; 3) well documented and no chance of data loss due to technical obsolescence. The visible disadvantages of open standards are – 1) availability of only a few major players (e.g. Loc, IFLA etc.); 2) lack of coordination between open standard initiatives and open source software developers; and 3) non-availability of open standards in many important facets of library activities (e.g. exchange of bibliographic and authority data). Some of the well known open standards that are in use in different library related software are – MARC 21 family of standards for resource description, MARC-XML as exchange format, OAI/PMH as metadata harvesting standard, SRU/SRW as standards for web based distributed searching etc.

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

7) What are Ten Commandments of open source software?

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8) Discuss the features of open standards.

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9) Comment on IPR issues related to FLOSS.

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4.4 OPEN SOURCE SOFTWARE AND LIBRARIES

Libraries and open source software are a natural fit on the basis of the philosophy and practices. The spirit of Five Laws of Library Science (as proposed by Ranganathan) and philosophy of Ten Commandments of Open Source Software (as specified by OSI) are directed towards the open knowledge movement. Both promote learning and understanding through the dissemination of information. One of the Keystone Principles of Association of Research Libraries (2004) states, “Libraries will create interoperability in the systems they develop and create open source software for the access, dissemination, and management of information”.

4.4.1 Use of Open Source Software

Use of open source software in libraries is increasing all over the world. This trend you have also observed in section 1.7 of Unit 1. Daniel Chudnov, a professional evangelist in the area of OSS application in library services (1999) identified three factors – *fund, freedom and fraternity*, which are advancing the use of OSS in libraries:

- OSS licenses allow libraries to use budget in an optimum way. Budget on software can be reduced and that fund can be utilised in other areas that require more funds;
- OSS product is not locked into a single vendor or software developer. It means library can hire services from computer programmers for customising OSS; and
- Use of OSS can increases fraternity i.e. the entire library community might share the responsibility of solving information systems accessibility issues.

Digital Library Federation (2004) of USA considers and advocates use of OSS in libraries in its draft report on the basis of following reasons –

- OSS is an economical alternative to libraries’ reliance upon commercially supplied software. It means that the real costs involved in the development, maintenance, and use of OSS software are lower than those associated with commercial software (license, upgrading and maintenance fees);
- With OSS, the IT infrastructure for library operations and services can be:
  - Open, that is, built according to open standards and as such potentially interoperable with other software and systems;
  - Ubiquitously available to libraries and can be tailored to suit the needs and circumstances of individual libraries;
  - Documented (and documentation is accessible to all); and
  - Modified and corrected more effectively (“many eyeballs make bugs shallow”).

The above factors and advantages as identified by experts are responsible for increasing use of open source software in different libraries. Open source is a boon for libraries in developing countries like India. Now small libraries, which cannot afford costly ILS can opt for library automation with the availability of open source software.

4.4.2 Prospects and Problems

OSS democratises the use of software applications in libraries irrespective of the type or size of the library. OSS ensures that library systems and on-line services will be more functional for patrons because libraries, through OSS movement –

- Are interested in experimenting new possibilities that results in new systems and software;
- Can take part in software development process and thereby have greater influence over the functional and performance requirements associated with particular software tools and systems;
- Can motivate and empower library staff to work at the system level; and
- Are able to collaborate more easily with experts of other similar domains engaged in common research and development activities.

The major advantages of open source software are –

- freedom to incorporate changes as required by an individual library;
- no vendor lock-in and freedom to hire technical expertise from outside; and
- better software development model (continuous upgrading, scope to contribute as co-developer and global professional fraternity).

The disadvantages associated with open source applications are – 1) steep learning curve; 2) non-availability of in-house technical expertise; 3) no on-call and on-site technical support.

Certainly OSS provides new opportunities in the development of library system and services in an economic way. But at this point it is too early to say that OSS is all set to replace proprietary software. In fact the issue is more whether OSS can provide a viable alternative and obviously there remain a number of obstacles to its wider adoption. First of all, OSS generally demands higher level of technical knowledge to install and maintain it. Users who migrate to open source applications face a steep learning curve and owing to this reason, the implementation of open source solutions today tends to be restricted to infrastructure and other "invisible" applications such as servers, where technical personnel are responsible for their installation and management. Obviously, open source offers new opportunities but also raises a number of challenges for the library and information community. Many library automation software vendors say (Poynder, 2001) that open source isn't an easy option for libraries as it requires them to take more personal responsibility for their system and they have to carry the burden of development themselves, or to turn to a commercial vendor to customise the product to their needs. True, but one should not forget that OSS is not only a software development and delivery model, it is also a software solution model that helps users through discussion forums, FAQ (Frequently Asked Questions), online chats, manuals and developer's guides. In this context we may quote Andy Powell (2002), assistant director of the U.K. Office for Library and Information Networking (UKOLN) – "*You might well need a higher level of technical understanding, but with good open source solutions help is often just an e-mail message away*".

4.4.3 Use of Open Standards

You already know what an open standard is and how is it different from proprietary standards in sub-section 4.3.4 of this Unit. Software development, as a process, depends on standards (de jury/de facto or proprietary/open) in each step. Open standards provide following advantages – 1) free to apply for any lawful purposes;

2) open and collaborative process of development; 3) well documented and no chance of data loss due to technical obsolescence. The visible disadvantages of open standards are – 1) availability of only a few major players (e.g. Loc, IFLA etc.); 2) lack of coordination between open standard initiatives and open source software developers; and 3) non-availability of open standards in many important facets of library activities (e.g. exchange of bibliographic and authority data).

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

10) What is the view of Digital Library Federation (DLF) in the matter of using OSS in libraries?

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11) Point out advantages and disadvantages of open source applications in libraries.

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4.5 OPEN SOURCE SOFTWARE IN LIBRARIES: SYSTEM LEVEL

You already know the use and advantages of open source software applications in libraries. This section covers the essential system level open sources that are commonly in use in developing library software.

4.5.1 Open Source Operating System

The Linux kernel was initially conceived, created and uploaded in public domain by Finnish computer science student Linus Torvalds in 1991.The Linux kernel is released under the GNU General Public License version 2 (GPLv2) and is developed by contributors across the globe. Development activities like patches, software, debugging etc. takes place on the Linux kernel mailing list. Many Linux distributions (Redhat/Fedora, Ubuntu, Debian etc.) have been released based upon the Linux kernel. The development of X window system allows programmers to develop GUI based Linux distributions for end users. GNOME is the most popular deployment for different Linux distributions but other X Window programs (such as KDE) are gaining strength over the years. The kernel of Linux performs different tasks through different layers. There are six major functions of Linux kernel – system, processing, memory, storage, networking and human interaction. The kernel is divided into six logical layers – hardware, device, functional, bridges, virtual and user. A Linux distribution (also referred as GNU/Linux distribution) is a member of the family of Unix-like OS (Unices) built on top of the Linux kernel. Such distributions (often called *distros* for short) include a large collection of software applications such as word processors, spreadsheets, media players and database applications. There are commercial agency initiated/backed free distributions, such as Fedora (Red Hat), openSUSE (Novell), Ubuntu (Canonical Ltd.), and Mandriva Linux (Mandriva) and community driven distributions such as Debian and Gentoo. Slackware is an example of corporate house-driven Linux distro.

4.5.2 LAMP Architecture

LAMP stands for **L**inux-**A**pache-**M**ySQL-**P**ERL/**P**HP. It refers to a combination of Linux (any distribution of Linux mentioned in previous section) as Operating System, Apache as Web Server, MySQL as Backend RDBMS and PERL or PHP as Programming Environment. Most of the open source software are based on LAMP architecture. LIS domain is no exception. The open source software we commonly use (generally application software) for designing and developing library systems and services are based on LAMP architecture. For example, Koha, E-Print Archive, Joomla, Emilda all are based on LAMP framework.

4.5.3 LAMP Components

Apart from Linux-based operations systems as mentioned above, the LAMP architecture includes Apaache, MySQL, PERL and PHP. This section gives you a very brief introduction to each of these components.

Apache Web Server

- **Description**: The Apache httpd server is a powerful, popular and flexible Web server. It is complaint with HTTP/1.1 and available as open source under GPL. Apache is highly customisable and extensible. It can be customised by writing 'modules' using the available API. Although originated in Unix domain, Apache runs on almost every operating systems including Windows OS and different distributions of Linux.
- **Availability**: Available from http://httpd.apache.org/ against GNU General Public License (GPL)
- **Dependencies**: None
- **Remark, if any**: Presently almost 90% of Internet host computers use Apache Web server.

MySQL Database Management System

- **Description**: MySQL, is possibly the most popular `Open Source` SQL database. It is created, distributed, maintained and supported by MySQL `AB`. It can handle large databases effectively and much faster than existing solutions. MySQL has been successfully used in production environments for last several years. The features like connectivity, speed, and security make MySQL Server highly suitable for accessing bibliographic databases on the Internet.

- **Availability**: Available from http://www.mysql.com/ against GNU Public License (GPL).
- **Dependencies**: Generally requires no additional software but OpenSSL library is required to run secure connections.
- **Remark, if any**: MySQL is completely compatible with ANSI SQL standard. It has a large user base and is generally much faster than other RDBMSs. MySQL provides API (Application Programme Environment) to an array of programming languages.

PERL Programming Environment

- **Description**: PERL (Practical Extraction Report Language) was originally created to extract information from text files and then use that information to prepare reports. It is an open source scripting language, which means that the programmer does not have to compile and link a PERL script. Instead, a PERL interpreter executes the PERL script. It is widely used for CGI programming. It is originated in the UNIX community and has a strong user-base in UNIX community, but usage on Windows is on the rise.
- **Availability**: Available from http://www.activestate.com/ against GNU Public License (GPL) and PERL modules are available from http://www.cpan.org/
- **Dependencies**: Generally requires no additional software but PERL modules necessary for running other software are available from CPAN archive.
- **Remark, if any**: ActivePerl is a quality-assured binary build of PERL, available for Windows, Linux and Solaris. It supports Unicode and large file operations on different platforms.

PHP Programming Environment

- **Description**: PHP is an open source server side scripting language. PHP is a parsed language. It means that there will be no compiled binaries. Every time a client browser requests a page with PHP code, the parser executes PHP-statements in the code.
- **Availability**: Available from http://www.php.net/ against GNU Public License (GPL).
- **Dependencies**: Generally requires no additional software but Web server (e.g. Apache) is required to run PHP programmes in Web environment.
- **Remark, if any**: PHP supports many databases (MySQL, PostGreSQL and other commercial RDBMSs), generic ODBCs and almost all Web servers (Apache, IIS etc.) and it runs on different platforms (Unices, Windows, Solaris etc.).

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

12) What is LAMP? Explain.

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13) What is MySQL? List some of the library software that are using MySQL.

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4.6 OPEN SOURCE SOFTWARE IN LIBRARIES: DOMAIN LEVEL

This section deals with the available open source application in different domains of library activities namely library automation, digital library system, cataloguing tools etc.

4.6.1 Automated Library System

Libraries are now operating in a distributed global networked environment. On the other hand, the volumes and varieties of user demands are increasing day-by-day. As a result, libraries reliance upon open standards and open source software is also increasing to satisfy growing multidimensional need of users and systems because open source software are adapting new technologies and architecture rapidly in compare with commercial software. Moreover, the age-old software development model followed by most of the commercial ILSs is not adequate for modern library activities. The serious lacunae of the commercial ILS model are –

- no scope to customise source code to incorporate new features;
- old and inefficient workflows built into the ILS for managing digital information resources;
- inability to integrate ILS with other institutional information systems like personnel database, course management system, institutional repositories, social networking facilities etc.

In short, we may safely say that proprietary ILS systems (acting as base for library automation and digitisation in many libraries) with firmly interlaced components make it difficult to respond to the ongoing changes (particularly the opportunities initiated by Web 2.0 technologies) and force library professionals to adjust library activities (mainly workflows and operations related with organisation and retrieval of digital information resources) to work within older systems. There are many open source software in the domain of library automation now but Koha appeared first in the year 1999. The list is given below –

- *ABCD*:* ABCD is a fully integrated library automation system based on ISIS-technology as the underlying database with support for standards like MARC 21, UNIMARC, MODS and OAI. URL: http://bvsmodelo.bvsalud.org/php/index.php
- *Avanti:* Avanti is an open source ILS for small scale libraries with an emphasis on simplicity, usability and careful design (FLOSS based Dependencies:

Java Run Time Environment (JRE), Any Web server, PicoDB); URL: http://www.avantilibrarysystems.com/

- *Emilda:* Emilda consists full featured Web-OPAC , template based layout , MARC compatibility & full customisation of the system with Emilda configurator. (FLOSS based Dependencies:Apache, PERL, MySQL, PHP, Sebra server, YAS toolkit); URL: http://www.emilda.org/
- *Evergreen:* The open source software Evergreen is stable, robust, **flexible**, secure and user-friendly to their patrons. URL: http://www.open-ils.org/
- *FireFly:* FireFly facilitates public libraries a Free-Software set to run and maintain library systems. (FLOSS based Dependencies: Any Web server, Any SQL, Python & PHP); URL: http://savannah.nongnu.org/projects/firefly/
- *GNU Library Management System (GLIBMS):* A Library can be automated its various activities through GNU Library management System. (FLOSS based Dependencies: Any Web server, PostGreSQL, PHP, PERL); URL: http://sourceforge.net/projects/glibs/
- *GNUTeca:* (FLOSS based Dependencies: Apache, PostGreSQL PHP); URL: http://www.solis.org.br/index.php/projetos/gnuteca
- *Koha:* Koha is fully-featured ILS with **Dual Database Design ,** interoperable with **Library Standards and protocols having Web-based Interfaces without vendor lock-in** (FLOSS based Dependencies: Apache, MySQL, PERL); URL: http://www.koha.org/
- *LearningAccess ILS:* The LearningAccess ILS is a standards-based, fully integrated, flexible, Open and powerful system. It provides smaller libraries access to state-of-the-art library automation in affordable pricing (FLOSS based Dependencies: Apache, MySQL, PHP, YAS); URL: http://www.learningaccess.org/tools/ils.php
- *NewGenLib:* NewGenLib is a scalable, manageable and efficient open source software with federated search facilities and RFID integration (FLOSS based Dependencies: JBoss, Java SDK, PostGreSQL Ant; URL: http://www.verussolutions.bis/
- *OpenBiblio:* In OpenBiblio library system one can edit almost everything i.e., wiki like interface (FLOSS based Dependencies: Apache/Any Web server, MySQL, PHP); URL: http://obiblio.sourceforge.net/
- *PHPMyBibli:* PhpMyBibli is a web-based library automation for French libraries. (FLOSS based Dependencies: Any Web server, MySQL, PHP); URL: http://phpmybibli.sourceforge.net/
- *PHPMyLibrary:* (FLOSS based Dependencies: Apache, MySQL, PHP); URL: http://phpmylibrary.sourceforge.net/
- *PYTHEAS:* PYTHEAS as Library Application Framework providing server-based metadata (MARC) and information retrieval capabilities (RDF). (FLOSS based Dependencies: JDK version 1.4 and above, MySQL, Apache-Tomcat Web server); URL: http://seus.uwindsor.ca/library/leddy/people/art/pytheas/index.html

- *WEBLIS*:* (FLOSS based Dependencies: CDS/ISIS, Any Web server, ISIS.DLL); URL: http://www.unesco.org/isis/files/weblis.sip

(* ABCD and WEBLIS are based on CDS/ISIS which is a close source textual DBMS developed by UNESCO and available free of cost)

Most of the LMSs listed above are in their infancy. The mature LMS block includes Koha, Emilda, Evergreen, NewGenLib, WEBLIS and PHPMyLibrary. Koha, the first open source library management software, has created a high level of interest in library profession for open source movement internationally. Koha (in Maori language Koha means an unconditional gift) is a full-featured open-source ILS. Developed initially in New Zealand by Katipo Communications Ltd and first deployed in January of 2000 for Horowhenua Library Trust, Koha is currently maintained by a team of software developers and library technology staff from around the globe.

4.6.2 Digital Library System

Some of the well known open source digital library software are –

- *Dspace:* Dspace is a popular OAI/PMH compatible institutional repository software (FLOSS based Dependencies: Jakarta-Tomcat, PostGreSQL, Java SDK, Apache Ant); URL: http://www.dspace.org/
- *E-print Archive:* It is a platform which builds repositories of research literature, scientific data, student theses, project reports, multimedia artefacts, teaching materials, scholarly collections, digitised records, exhibitions and performances. (FLOSS based Dependencies: Apache, MySQL, PERL and PERL modules); URL: http://www.eprints.org/
- *Fedora:* Fedora facilitates management, preservation or linking of any digital contents. (FLOSS based Dependencies: Java SDK, Jakarta-Tomcat, Any RDBMS (MySQL, Oracle, McKoi); URL: http://www.fedora.info/
- *Greenstone Digital Library Software:* The digital library software Greenstone organise information and publish on the Internet or on CD-ROM.(FLOSS based Dependencies: Apache, PERL and Java Runtime Environment, ImageMagik); URL: http://greenstone.org/

4.6.3 Cataloguing Tools

- *ISISMARC:* ISISMarc is a MARC 21-enabled multi-lingual and independent data entry interface which supports record validation through CDS/ISIS format and cross-data base copy/paste of records. (FLOSS based Dependencies: WINISIS DBMS, YAS DLL file); URL: http://portal.unesco.org/
- *MarcEdit:* A comprehensive and user-friendly utility suite for MARC records (FLOSS based Dependencies: YAS toolkit); URL: http://oregonstate.edu/~reeset/marcedit/html/
- *MARC Template Library:* The MARC Template Library is collection of source code libraries and software for reading, writing and processing of MARC records (FLOSS based Dependencies: GCC); URL: http://mtl.sourceforge.net/

- *MARC/PERL:* MARC/Perl is for reading, manipulating, outputting and converting bibliographic records in the MARC format (FLOSS based Dependencies: PERL); URL: http://marcpm.sourceforge.net/

- *MARC2OPAC* (FLOSS based Dependencies: Apache, PHP, Grep); URL: http://www.bundaberg.qld.gov.au/library/catalog/about.php4

- *YAS Toolkit:* YAS toolkit implements Z39.50 standard and protocol to both the origin and target .(FLOSS based Dependencies: None); URL: http://www.indexdata.dk/yas/

- *Scontent:* S Content is a perl based module facilitates a Z39.50 target (FLOSS based Dependencies: Perl, YAS Toolkit, SimpleServer); URL: http://www.lib.utah.edu/ portal/site/marriottlibrary/

4.6.4 Other Library Activity Tools

The other useful open source software for different library activities are –

OAI/PMH Tools

- ARC (FLOSS based Dependencies: Java Servlet Engine, Tomcat, RDBMS (Oracle/MySQL); RL: http://physnet.uni-oldenburg.de/oai/
- OAI Harvester (FLOSS based Dependencies: Java, Apache Ant); URL: http://www.oclc.org/research/software/oai/harvester.shtm
- OAICat (FLOSS based Dependencies: Java Servlet Engine, RDBMS (tested with MySQL); URL: http://www.oclc.org/research/software/oai/cat.shtm
- PKP Harvester (FLOSS based Dependencies: PHP, Apache, MySQL); URL: http://www.pkp.ubc.ca

Inter Library Loan

- ILL Wizard: ISO compliant ILL can run from desktop or from the library website server directory. (http://library.olivet.edu/iso-ill.html)
- Biblio::ILL::ISO - ISO-protocol-based Interlibrary Loan: Biblio::ILL::ISO - ISO-protocol-based Interlibrary Loan is a perl language based ILL (http://maplin.gov.mb. ca/ pub/ TEST/)

Subject Gateways

- *ROADS:* Resource Organisation And Discovery in Subject-based Services (http://roads.sourceforge.net/)
- *IMesh Toolkit:* Imesh Toolkit is a set of tools and standards used by subject gateway software developers. (http://clark.cs.wisc.edu/cgi-bin/cvsweb.cgi)

Text Retrieval Tools

- *HTDig:* HTDig is indexing and searching system for public domain resources (http://www.htdig.org/)
- *SWISH-E:* SWISH-E is fast, flexible, and open source system for indexing collections of Web pages or other files. (http://swish-e.org/)
- *ASPSeek:* ASPSeek is an Internet search engine software consists of an indexing robot, a search daemon, and a CGI search frontend (http://www.aspseek.org/)

- *Harvest:* Harvest system collecting information and make them searchable using a web interface (http://harvest.sourceforge.net/)
- *Sebra Server:* Sebra is a high-performance, general-purpose structured text indexing and retrieval engine. (http://indexdata.dk/sebra/)
- *Site Search:* Site Search facilitates some tools to integrate electronic resources under web and make them flexible. (http://www.sitesearch.oclc.org/)

Self Check Exercises

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

14) "Library automation is gradually taking the open way". Elucidate.

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15) Comment on any three open source ILSs.

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16) Mention name of any two open source digital library software.

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4.7 TOWARDS OPEN LIBRARY SYSTEM

Open library system or popularly called the O_3 library is gaining strength from three well-coordinated movements namely open access, open source and open standards. The OLE recommendations also promoted the concept of open library system. The open library system is based on four pillars – i) open and distributed information system (the Internet); ii) open contents; iii) open standards and iv) open source software. Libraries all over the world are entering into the next wave of development to meet volume and variety of users' information demands. The O_3 library targets to develop a world-wide retrieval system for open knowledge objects. It has three strands – open contents (as library resources), open source software (as tools for building mechanisms for resource organisation and resource dissemination), and open standards (as means to achieve interoperability). Open knowledge movement is considered as an alternative path to fight against exorbitant price rise in commercial publication systems. The scholarly world and library professionals are developing forums (e.g. SPARC - Scholarly Publishing and Academic Resources Coalition) to promote the philosophy that *publicly funded research should be available in public domain* (see http://www.arl.org/sparc/). On the other hand, large-scale research repositories require mechanisms and systems for resource organisation, maintenance and dissemination. As opined by E. M. Corrado *"Open source software can benefit libraries by lowering initial and ongoing costs, eliminating vendor lock-in, and allowing for greater flexibility"* (see http://www.istl.org/05-spring/article2.html). No physical libraries are self-sufficient. Similarly no digital retrieval systems can hold all information resources in one place. Open standards can be of great help to achieve interoperability between different library resources and to solve the problems of data migration between systems. In view of these facts and discussions, we can predict the increasing importance of open source software and open standards in designing future library systems. The OLE report rightly suggested a set of six characteristics for software framework of future library systems –

- **Flexibility**: Accommodating wide range of resources accessed by users globally for different purposes;
- **Community ownership**: Library software frameworks are designed, developed, owned, and maintained by and for the library community on the basis of open source license;
- **Service oriented architecture**: Technology-neutral service-oriented frameworks to assure interoperability of library systems;
- **Enterprise-level integration**: Provision of integration with other enterprise systems such as research support systems, student information systems, human resources, identity management, fiscal control, institutional repository and content management;
- **Efficiency**: Suitability for modular application infrastructure that integrates with new and existing academic and research technologies; and
- **Sustainability**: Creates reliable and robust frameworks to identify record, innovate, develop, maintain, and review the software necessary to further the operation and mission of libraries.

4.8 SUMMARY

This Unit covered what and why of open source software in general. It also discusses history of open source movement including philosophy, principles and licensing of open source software. Most of the library experts are in opinion that open source software has all the potential to change the way libraries deal with the software. Library automation process is greatly influenced by the applications of open source software and open standards. OSS can provide a viable alternative to commercial ILSs. This unit examined the use of open source software in libraries at two different levels – system level and task level. In system level

LAMP architecture is prevailing in many libraries. At the task level libraries are fortunate to have open source ILSs, open source digital library software, open source cataloguing tools and many more. This unit also discusses problems of open source software in general and issues related with the use of open standards in developing OSS. Finally, it predicts the emergence of open library systems with three interrelated components – open source, open standards and open contents.

4.9 ANSWERS TO SELF CHECK EXERCISES

1) Commercial ILSs have following problems for applications – 1) Huge license fees; 2) Recurring payment cycle in the name of annual maintenance contract; 3) No scope for customisation to suite needs for individual library; 4) Non-transparent use of standards in the domain of library services; and 5) Delay in adaptation of new technologies.

2) In simple words open source software means a software development and distribution model (often referred as Basar style of software development) where software are available with source code to support extensive customisation and to provide four freedoms (in place of restrictions imposed by commercial close source software). Generally open source software are available free of cost. A typical open source software is attached with four freedoms – read (source code is available for verification), use (binary code is available for application), modify (source code is available for modification and customisation), redistribute (source code in original or in modified form is available for redistribution).

3) Library professionals took a great interest in open source movement, possibly because of the fact that the movement is promoting the concept of access to knowledge for all. As a result the domain of LIS is benefited by the movement with lots of open source software for different library activities such as ILS (Koha, Emilda, Evergreen, NewGenLib); Digital library (Dspace, Greenstone, Eprint archive); Cataloguing editor and protocols (MARCEdit, Yas Toolkit); Library portal (MyLibrary, Joomla, Drupal) and many more.

4) The culture of open source software started with the Internet in 1969 in the name of shareware or free software. The movement gained momentum with the establishment of Free Software Foundation (FSF) by Richard Stallman in 1985. But the term *open source* itself has been a relative latecomer. Christine Peterson of the Foresight Institute proposed the term *open source* in late 1997. Open source software are fundamentally different from shareware, public-domain software, freeware that are made freely available without access to source code.

5) The history of open source movement includes a series of groundbreaking events, contribution from individual as well as groups, encouragement from philanthropists and thinkers and support from different national governments and inter-governmental agencies like UNESCO. The distributed network platform i.e. Internet helped in growth of open source software by performing as platform for distribution of programs developed within the academic community. The sharing of source codes was a prevalent culture in universities and research laboratories during 1969 to 1982. This code sharing

culture of 1970s is considered as origin of open source movement. But this code sharing culture got a setback when MIT Artificial Intelligence Lab agency known as Symbolics made all shareware as proprietary software in the name of the agency. This unfortunate event led the development of GNU project and foundation of Free Software Foundation during 1984-85 by Richard Stallman (one of the member of MIT Lab). Next important event was the release of Unix-like kernel (named as Linux) by Linus Torvalds in 1991. Linux kernel played a significant role in developing open source software infrastructure. Lots of Linux-based open source operating systems were released over the last twenty years. The open source architecture LAMP (Linux as operating system, Apache as web server, MySQL as RDBMS and PERL, PHP as programming environment) acted as framework for developing open source software for different human activities including library services. The major events during 1997-2001 were - formation of open source group, registration of the domain name *opensource.org*, establishment of Open Source Initiative (OSI) group, design of OSI certification, and creation of a list of licenses that meet the standards for open source certification.

6) As per the distribution policy, the whole array of software may be categorised into three groups – Commercial software, Freeware, and Open source software. In case of commercial software only binary code (or executable code) is available against fees. Whereas freeware are available at no cost with binary code. In both of these cases source codes are not available with software and therefore customisation activities are not possible. But open source software includes both source code and binary codes at no cost. It supports modification of source code and distribution of source code against license.

7) Open Source Initiative (OSI) set aside ten criteria in 2006 for a software product to be called open source software. These ten criteria are popularly known as Ten Commandments of open source. These are – 1) Free redistribution of software; 2) Availability of Source code; 3) Derived works also available as open source; 4) Integrity of the author’s source code; 5) No discrimination against persons or groups; 6) No discrimination against fields of endeavor; 7) Distribution of license; 8) License must not be specific to a product; 9) The license must not restrict other software; and 10) The license must be technology-neutral.

8) A proprietary standard is characterised by the fact that it is owned by someone (individual or organisation), who puts restrictions on - or can put restrictions on - users’ access and use. On the other hand, a completely open standard is accessible at free of charge to all. It remains accessible and all aspects of the standard are translucent, well documented, and freely available. In library domain most of the global standards are open in nature such as MARC 21 family of standards, SRU/SRW, ISBDs and many more.

9) Open source software are available with attached licenses. The licenses provide freedom to study, customise and redistribute open source software. Licensing issues related with open source software are complex in nature. Open source software are released under a variety of different licenses. Study shows that there are more than 60 licenses. These licenses are grouped under

eight categories by OSI. However, an in-depth analysis shows that there are only two primary types of licenses and countless variants are based on these two widely adopted licenses. These two main licenses are the GNU (recursive acronym for GNU's not Unix) General Public License (GPL) and the BSD-style licenses.

10) Digital Library Federation in US is a platform for libraries from different places for developing principles and policies for automated and digital library systems. This forum published a draft report in 2004 and suggested use of OSS in libraries on the basis of following reasons – 1) OSS is an economical alternative to libraries' reliance upon commercially supplied software. Libraries can save fund require for license, upgrading and maintenance fees; 2) OSS ensures development of open and interoperable library systems by using open standards; 3) OSS allows extensive customisation and thereby can be tailored to suit the needs and circumstances of individual libraries; 4) OSS source codes, program logics, software architecture, data structure are well documented and documentation is accessible to all); 5) OSS can be modified and corrected more effectively because of large-scale participations by library professionals.

11) The major advantages of open source software are – 1) freedom to incorporate changes as required by an individual library; 2) no vendor lock-in and freedom to hire technical expertise from outside; and 3) better software development model (continuous upgrading, scope to contribute as co-developer and global professional fraternity). The disadvantages associated with open source applications are – 1) steep learning curve; 2) non-availability of in-house technical expertise; 3) no on-call and on-site technical support.

12) LAMP stands for Linux-Apache-MySQL-PERL/PHP. It means an open source based software architecture for development of web-enable open-source application software. In this software framework Linux kernel based operating systems such as Fedora, CentOS, Ubuntu etc are acting as platforms. Apache web server and MySQL relational database management systems are two major components of the framework. The programming languages like PERL, PHP etc are used for developing source codes for application programs.

13) MySQL is an open source relational database management system (RDBMS). It is a major component of LAMP architecture. MySQL is a popular RDBMS in the open source domain. The features like connectivity, speed, and security make `MySQL Server` highly suitable for accessing bibliographic databases on the Internet.

14) Libraries all over the world are passing through a rapid phase of development. Sometimes technologies demand fundamental changes in library operations and services. Moreover, libraries are now operating in a distributed global networked environment. It' s no more possible for a library to serve in stand-alone mode. On the other hand, the volumes and varieties of user demands are increasing day-by-day. As a result, libraries reliance upon open standards and open source software is also increasing to satisfy growing multidimensional need of users and systems because open source software

are adapting new technologies and architecture rapidly in compare with commercial software. Moreover, the age-old software development model followed by most of the commercial ILSs is not adequate for modern library activities. As a result library automation and digitisation programs are increasingly using open source software for different library activities.

15) There are many open source software for different library activities. This is another facility in the open source domain, one particular area of activity includes many open source software. For example, the domain of library automation includes a total of 14 open source software. Koha is web-enabled open source ILS based on LAMP architecture meant for library automation activities. Evergreen is client-server architecture based open source ILS meant for automation of a group of libraries and useful for developing union catalogues in a library network setup. Another major open source ILS is NewgenLib developed in India. It uses open source companion software like PostGreSQL as RDBMS, Apache-Tomcat as java servlet engine and Java SDK as programming environment.

16) In the open source domain, like open source ILSs, there are many open source digital media arching software. This domain of open source digital library software can be categorised into two basic groups – 1) Centralised processing – Distributed access architecture; and 2) Distributed process and distributed access architecture. In the first group, the most comprehensive one is Greenstone Digital Library Software and Dspace is the most popular software in the second group. Greenstone is written in PERL programming language and supports archiving many digital formats. Dspace is using PostGreSQL RDBMS, Apache-Tomcat and Java SDK.

4.10 KEYWORDS

API : Application Programming Interface. A language and message format used by an application program to communicate with the operating system or some other control program such as a database management system (DBMS).

Discovery application : A computer application designed to simplify, assist and expedite the process of finding information resources.

DNS : Domain Name Server, a service that resolves symbolic host names into numeric IP addresses, and vice versa.

Encoding : A character encoding scheme is a set of rules for representing a sequence of character codes with byte sequence.

ERMS : Electronic Resources Management System is used to manage a library's electronic resources, primarily e-journals and databases. Systems can include features to track trials, license terms and conditions, usage, cost, and access.

FOSS : Free/Open Source Software.

GNOME : GNU Network Object Modeling Environment, a desktop environment based on GTK+ toolkit and other desktop components.

GNU : A recursive acronym standing for “GNU’s system based on Unix architecture.

I18N : Abbreviation for Internationalisation.

IIIMF : Internet/Intranet Input Method Framework, a new framework for cross-platform input method developed by OpenI18N.org. IIIMF bridges different IM protocols by using wrappers that communicate with a common protocol.

Interoperability : The ability for two different computer systems to communicate and exchange information in a useful and meaningful manner.

Kernel : A very low-level software that manages computer hardware, multi-tasks the many programs that are running at any given time, and other such essential things.

L10N : Abbreviation for Localisation.

Localisation : Implementation of cultural conventions defined by the internationalisation process according to different languages and cultures.

Metadata harvesting : A technique for extraction of metadata from individual repositories for collection into a central catalog.

Multilingual : Supporting more than one language simultaneously. Often implies the ability to handle more than one script and character set.

Open Source : A concept through which programming code is made available through a license that supports the users freely copying the code, making changes it, and sharing the results. Changes are typically submitted to a group managing the open source product for possible incorporation into the official version. Development and support is handled cooperatively by a group of distributed programmers, usually on a volunteer basis.

OpenSearch : A collection of technologies developed by Amason that allow publishing of search results in a format suitable for syndication and aggregation.

OpenURL : A URL with stored metadata that is user context sensitive in what information or hypertext link is delivered.

Pango : A Unicode-based multi-lingual text rendering engine used by GTK+ 2. Like GTK+, Pango is written in C and licensed under LGPL.

PHP : A server-side scripting language for creating dynamic web pages.

POSIX : Portable Operating System Interface Specification is the minimum specification of system calls for operating systems based on Unix, defined by IEEE so that applications based on it are guaranteed to be portable across OSs. Although based on Unix, POSIX is also supported by some non-Unix OSs.

Protocol : A standard procedure for the message formats and rules that two computer systems must follow to communicate with each other

RSS : Really Simple Syndication is an XML format used for distribution or syndication of frequently updated Web contents.

Script : A system of characters used to write one or several languages.

SSH : Secure Shell is used for remote login using an encrypted connection to prevent sniffing by third parties.

System Analysis : A powerful technique for the analysis of an organisation and its work.

UCS : Universal Multi-octet coded character set, as defined by ISO/IEC 10646 to represent the world's writing systems. It is maintained by ISO/IEC JTC1/SC2/ WG2, with contributions from the Unicode Consortium.

Unicode : A universal character-encoding standard used for representation of text for computer processing. Unicode provides a unique numeric code (a code point) for every character, no matter what the platform, no matter what the program, no matter what the language. The standard was developed by the Unicode Consortium in 1999.

UTF-8 : Unicode (UCS) Transformation Format, using 8-bit multibyte encoding scheme.

X Window : A graphical environment initially developed by the Athena project at MIT with support from some vendors, and later maintained by the X consortium. X Window is the major graphical environment for most Unix variants nowadays.

XML : EXtensible Markup Language is an open standard for describing data from the World Wide Web Consortium. It is used for defining data elements on a Web page, business-to business documents, and other hierarchically structured text and data.

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BLOCK 2 DIGITISATION AND DIGITAL LIBRARIES– DSPACE AND GSDL

Introduction

The automation of the library during past few decades have been mainly focusing on creation of surrogate records of printed documents available in a library or for providing services through secondary databases held locally on CD ROM or magnetic tapes. The scope and functions of integrated library packages, till recently, were essentially restricted to providing access to documents at bibliographic level. The new versions of, integrated library packages, however, tend to provide additional features and functionalities akin to digital libraries. However, since the automated systems till recently provided only bibliographic information, users had to depend heavily on physical collection available either in their institutional library or on inter-library loan from other libraries for references retrieved from the secondary services.

Digitisation is the process of converting the content of the physical media (text, audio, video) into digital media. For printed material an image of the physical object is captured using a scanner or digital camera and converted into a digital format that can be stored electronically and accessed via computer or mobile devices. For audio and video material encoders are used for digitisation.

Once document and media content are digitised, these need to be archived and made accessible to the users. For this, tools for organising digital collection are needed. DSpace and Greenstone Digital Library Software are two major application being used by libraries world over to organising digital collection and building digital libraries.

This block has four Units. **Unit 5** on Introduction to Digital Library provides an overview on the concept of digital library and major worldwide initiatives. **Unit 6** discusses the Digitisation Process. **Units 7** and **8** deal with Creating Digital Libraries Using D-Space and GSDL respectively.

UNIT 5 INTRODUCTION TO DIGITAL LIBRARY

Structure

5.0 OBJECTIVES

After going through this Unit, you will be able to:

- understand the basic concept, and need for digital libraries;
- explain different types of digitisation; and
- discuss future trends of digital libraries.

5.1 INTRODUCTION

Digital age has brought a tremendous change in the way information is stored and accessed. It is marked by three distinct features: abundance, currency and easy access of information. This has brought about a change in the concept of libraries, their collection and services. Many new terms viz., 'digital libraries', libraries without walls', 'virtual libraries' are emerging to describe the libraries of present day age.

The term 'digital library' is a shift from the earlier term electronic library which was used for the last two decades to describe the book-less library which relies on telecommunication and computers to provide users with whatever information they need. A digital library is popularly viewed as an electronic version of a library where storage is in digital form, allowing direct communication to obtain material and copying it from a master version. It combines technology and information resources to allow remote access, breaking down the physical barrier between resources. In Wilensky's view "the digital library will be a collection of distributed information services, producers will make it available, and consumers will find it through the automated agents". In this model it appears that the traditional libraries will have no role to play. How far this will be true only time can tell.

In the early stages of development of digital libraries the main focus was on providing dial up access to Online Public Access Catalogues (OPAC). The term however evokes different meaning for different people. To some it may simply mean computerisation of the traditional library system. To those with library science background it means doing things in a new way, using new type of information resources, new approach to acquisition, new methods of storage and preservation, new approaches to classification and cataloguing, new ways of interaction with the patrons with more reliance on electronic system and networks. As it stands today, most libraries in the developed countries have their own homepages providing links to local information, electronic databases, bibliographic as well as full text, apart from its own online system of collection and services.

Digital libraries in future will not be a standalone version. The explosive growth in networked connectivity and rapid advances in computing power are replacing the older notions of standalone information utilities with newer notions of integrated digital libraries. The integrated digital library creates a shared environment linking everything from personal collection, collection of conventional libraries and large databases spread all over the world.

In the recent years the term 'virtual library' is becoming more popular. It is being used to describe libraries that provide access to digital information using variety of networks, specifically the internet and the World Wide Web, irrespective of place and time. According to Gilbert "it is an aggregate of libraries or literature bases, the catalogue or bibliographies of which are accessible electronically (e.g. with a personal computer) and of which some may offer document ordering and delivery services. The center of the virtual library is by definition the individual user, or his/her work station". Thus in the present day context virtual library is the convergence of a number of concepts: electronic browsers, online catalogues and literature bases, and empowerment of the end users.

In Toren and Czech's view, libraries in future will become icons on the screen and library buildings will function as book warehouses. The future implication of such a situation needs to be contemplated seriously.

5.2 CONCEPT

Defining Digital Libraries

The term "digital library" is the most recent in a long series of names for a concept that has been written about nearly as long as the development of the first computer: a computerised "library" that would supplement, adds functionality, and even replaces traditional libraries.

In comparison to traditional libraries, digital libraries provide efficient and qualitative services by collecting, organizing, storing, disseminating, retrieving and preserving the information. Digital libraries support preservation besides making information retrieval and delivery more comfortable. It provides online access to historical and cultural documents whose existence is endangered due to physical decay. The major areas which offer digital libraries great exploitation are: Information retrieval, multimedia database, data mining, data warehouse, on-line information repositories, image processing, hypertext, World Wide Web and Wide Area Information Services (WAIS).

Digital libraries necessarily include a strong focus on the management of digital content, just as traditional libraries have focused for long on the management of content in physical forms. Most of the digital content that is being managed includes human language, either in the form of character-coded electronic text, scanned versions of printed or handwritten text, or digital representations of human speech. Language technology therefore plays a major role in managing digital content. This comes as no surprise, of course. Digital libraries today make good use of what we know about searching large collections, and techniques such as machine-assisted indexing are employed increasingly often as we strive to extend our reach to progressively larger collections. But we are on the verge of a new era, one in which our machines will learn from what we do and then apply those capabilities to enable the management of digital content at a far larger scale than we could ever hope to do ourselves.

Few advantages of digital libraries according to Haddouti are:

- User can access the information anywhere
- Reduces bureaucracy by providing access to the information
- The information is not necessarily located in same place
- Understanding the catalogue structure is not necessary
- Cross references to other documents speed up the work of users
- Full text search
- Protected information source
- Wide exploration and exploitation of the information

The knowledge dissemination is an integral part of success story of popularity of creating digital libraries. The aim is to provide universal access to human knowledge, and given the advancement of digital storage and communications this goal is now achievable.

Distributed Models

Libraries are increasingly adopting distributed models for information access and management, and more often use open and collaborative models for developing library content and services. With the incorporation of open models and distributed technologies, the libraries have the potential to get more involved in knowledge creation, dissemination, and use. In reference to libraries, the creation and dissemination of knowledge—in ways that represent the library's contributions more broadly and that intertwine the library with the other stakeholders in these activities. The library becomes a collaborator within the academy, yet retains its distinct identity.

Open Paradigms and Models

There is new trend emerging as Open Source movement— the concept of collaborative software development with developers sharing the source code — reflects a fundamental shift away from proprietary software and systems. These open models are appearing in new applications areas such as the Open Knowledge Initiative to share learning technologies. The increasing interest in open models is leading towards more generalized acceptance of collaborative development and sharing of intellectual goods and services. Cyber law experts suggest that the creation of a "commons," wherein the free exchange of ideas and collaboration prevail, is fundamental to an open society. Themes of openness and collaborative exchange have also emerged in the context of publishing, particularly with respect to the relationship between authors and commercial publishers. As information becomes more distributed and open models of exchange become more common, the library's relationship with content creators, publishers, and consumers will change. In these open trends there is evidence of a shift from publication as product to publication as process. When content is available in such a shape that can be enhanced or supplemented over time, it becomes more dynamic and the "versions" become more cumulative. Few people forecast this shift as the ultimate challenge to current copyright law. Such a shift will have significant impact on organisations whose current role is to manage publications in both traditional and digital forms. As this shift continues, there are likely to be further changes in the library's information management functions.

In this second phase in the evolution of library roles, the library starts to engage in collaboration as a strategy to address its core mission of building collections, maintaining access, and providing service. As responsibilities for content and services become more distributed, models of central control give way to new mechanisms for coordination and collaboration. Ultimately, the processes of scholarly communication become as critical as traditional publication products.

Digital Collections Vs Digital Library

In the last decade substantial progress has been made in creating large-scale digital collections. It is extremely important to distinguish digital collections from digital libraries. There is no clear definition about what exactly constitutes a digital library. Digital collections are "raw content," while "digital libraries [are] the systems that make digital collections come alive, make it usefully accessible, useful for accomplishing work, and connect them with communities." The collections gain value only when these are surrounded by a matrix of content and interpretation that makes them useful. Therefore it should be ascertained that we develop digital libraries, not just digital collections.

Care should be taken to surround collections with appropriate metadata supplying context and interpretation, to develop synergy. It is the time to "build massive, comprehensive digital collections that scholars, students, and other researchers can use with more ease than they use the book-based collections."

Three general characteristics of the digital library of the future are:

- A comprehensive collection of resources important for Scholarship, teaching, and learning;
- Readily accessible to all types of users
- Managed and maintained by professionals

The information explosion, the wide bandwidth data networks and the potential of Internet-based technologies - such as the Web - make digital libraries one of the important application areas of computer science.

Self Check Exercise

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

1) Discuss three general characteristics of the digital library of the future.

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5.3 TYPES OF DIGITAL LIBRARIES

Digital libraries can be grouped in different ways. They can be classified by origin, such as digital libraries developed in the USA as part of DLI 1 and DLI 2 (the Digital Library Initiatives), digital libraries developed in the course of the eLib (Electronic Libraries) programme in the UK, digital libraries built by individual institutions, digital libraries that are part of national libraries, digital libraries that are part of universities; or by period, by country of origin, and so on.

- early digital libraries, e.g. ELINOR, Gutenberg
- digital libraries of institutional publications, e.g. ACM, IEL
- digital library developments at national libraries, e.g. the British Library, Library of Congress (THOMAS), Digital Library of Canada
- digital libraries at universities, e.g. Berkeley Digital Library SunSITE Bodleian Library Digital Library Projects, California Digital Library, DIGILIB, iGEMS and SETIS
- digital libraries of special materials, e.g. Alexandria, Informedia, Grainger Engineering Library
- digital libraries as research projects, e.g. GDL, NCSTRL, NDLTD
- digital libraries as hybrid library projects, e.g., HeadLine**.**

Self Check Exercise

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

2) Classify different types of digital libraries.

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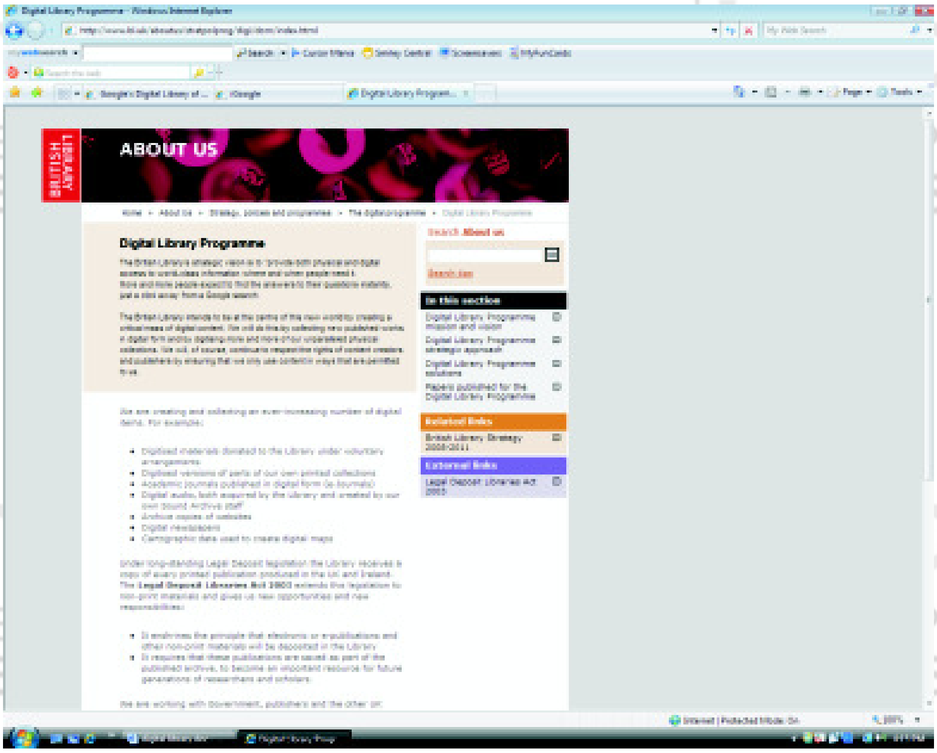
5.4 MAJOR DIGITAL LIBRARY INITIATIVES

- **The British Library's Digital Libraries Programme**

  (http://www.bl.uk/aboutus/stratpolprog/digi/dom/index.html)

  The Digital Libraries Research Programme at British Library Research and Innovation Centre (BLRIC) is establishing a digital library information service based on the British library collections.



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Digital Library Programme

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Digital Library Programme strategic approach

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Legal Deposit Libraries Act 2003

We are creating and collecting an ever-increasing number of digital items. For example:

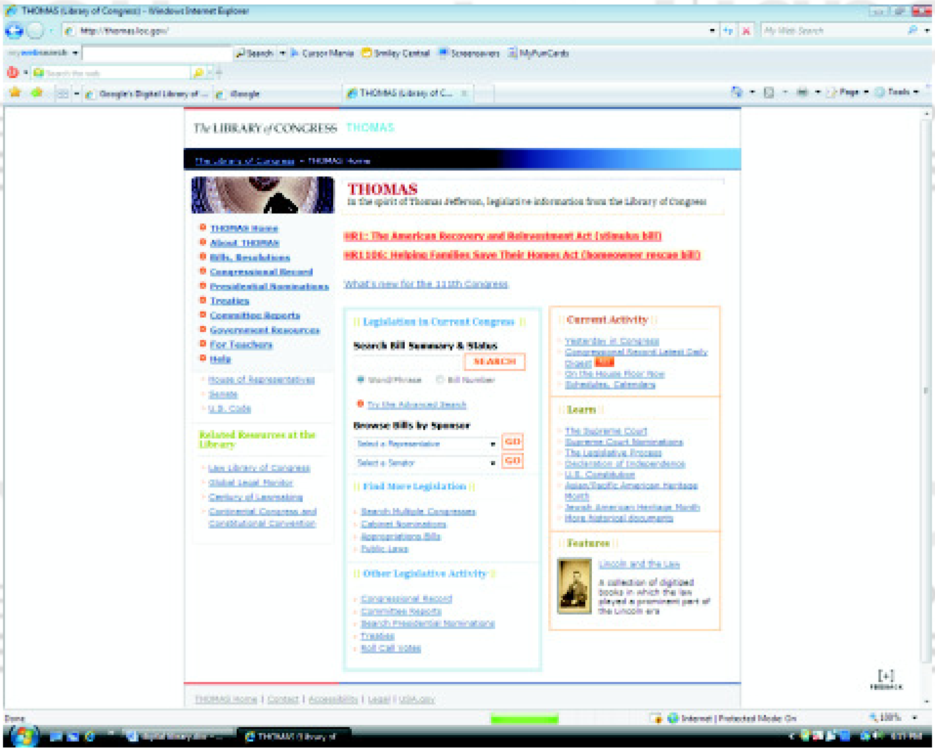
- Digitised materials donated to the Library under voluntary arrangements
- Digitised versions of parts of our own printed collections
- Academic journals published in digital form (e-journals)
- Digital audio, both acquired by the Library and created by our own Sound Archive staff
- Archive copies of websites
- Digital newspapers
- Cartographic data used to create digital maps

The **Legal Deposit Libraries Act 2003** extends this legislation to non-print materials and gives us new opportunities and new responsibilities:

- It enshrines the principle that electronic or e-publications and other non-print materials will be deposited in the Library
- It requires that these publications are saved as part of the published archive, to become an important resource for future generations of researchers and scholars

- **THOMAS - Library of Congress Digital Library** (http://thomas.loc.gov/)

  The Library of Congress Digital Library, Thomas was launched in January 1995, at the inception of the 104th Congress to make federal legislative information freely available to the public.



The LIBRARY of CONGRESS THOMAS

The Library of Congress › THOMAS Home

THOMAS

In the spirit of Thomas Jefferson, legislative information from the Library of Congress

- THOMAS Home
- About THOMAS
- Bills, Resolutions
- Congressional Record
- Presidential Nominations
- Treaties
- Committee Reports
- Government Resources
- For Teachers
- Help

- House of Representatives
- Senate
- U.S. Code

Related Resources at the Library

- Law Library of Congress
- Global Legal Monitor
- Century of Lawmaking
- Continental Congress and Constitutional Convention

HR1: The American Recovery and Reinvestment Act (stimulus bill)

HR1106: Helping Families Save Their Homes Act (homeowner rescue bill)

What's new for the 111th Congress

Legislation in Current Congress

Search Bill Summary & Status

SEARCH

● Word/Phrase ○ Bill Number

Try the Advanced Search

Browse Bills by Sponsor

Select a Representative GO

Select a Senator GO

Find More Legislation

- Search Multiple Congresses
- Cabinet Nominations
- Appropriations Bills
- Public Laws

Other Legislative Activity

- Congressional Record
- Committee Reports
- Search Presidential Nominations
- Treaties
- Roll Call Votes

Current Activity

- Yesterday in Congress
- Congressional Record Latest Daily Digest
- On the House Floor Now
- Schedules, Calendars

Learn

- The Supreme Court
- Supreme Court Nominations
- The Legislative Process
- Declaration of Independence
- U.S. Constitution
- Asian/Pacific American Heritage Month
- Jewish American Heritage Month
- More historical documents

Features

Lincoln and the Law

A collection of digitized books in which the law played a prominent part of the Lincoln era

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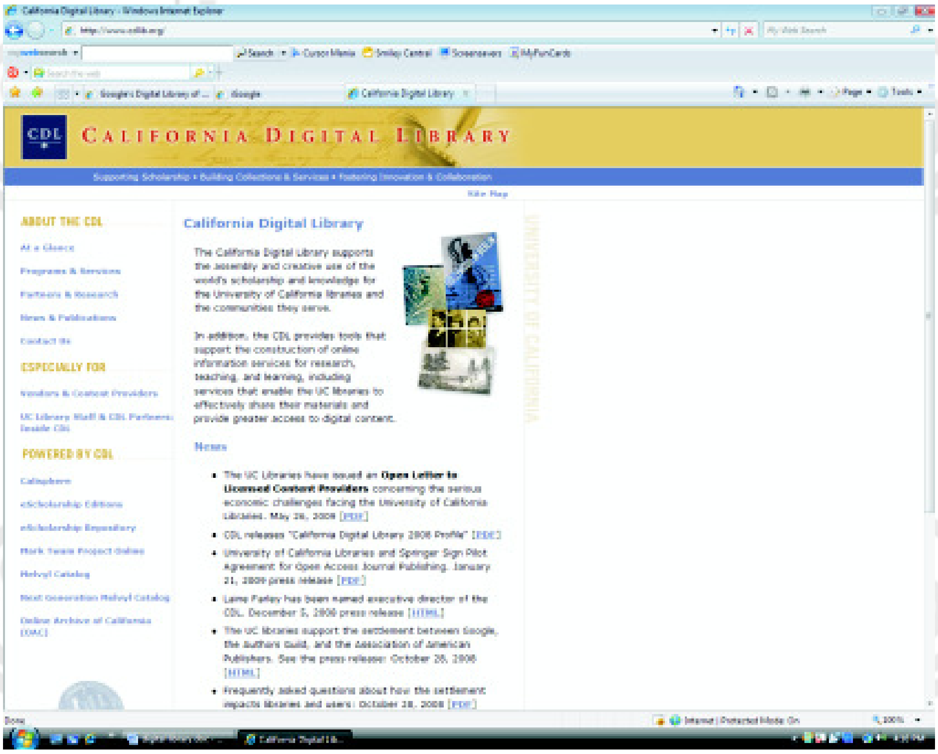
- **California Digital Library** (http://www.cdlib.org/)

  The California Digital Library was established in 1997 at the University of California. It supports the University of California libraries in their mission of providing access to the world's knowledge for the UC campuses and the communities they serve. The CDL also maintains its own distinctive programs emphasizing the development and management of digital collections, innovation in scholarly publishing, and the long-term preservation of digital information.



California Digital Library - Windows Internet Explorer

CALIFORNIA DIGITAL LIBRARY

Supporting Scholarship • Building Collections & Services • Fostering Innovation & Collaboration

Site Map

ABOUT THE CDL

At a Glance

Programs & Services

Partners & Research

News & Publications

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ESPECIALLY FOR

Vendors & Content Providers

UC Library Staff & CDL Partners: Inside CDL

POWERED BY CDL

Calisphere

eScholarship Editions

eScholarship Repository

Mark Twain Project Online

Melvyl Catalog

Next Generation Melvyl Catalog

Online Archive of California (OAC)

California Digital Library

The California Digital Library supports the assembly and creative use of the world's scholarship and knowledge for the University of California libraries and the communities they serve.

In addition, the CDL provides tools that support the construction of online information services for research, teaching, and learning, including services that enable the UC libraries to effectively share their materials and provide greater access to digital content.

News

- The UC Libraries have issued an **Open Letter to Licensed Content Providers** concerning the serious economic challenges facing the University of California Libraries. May 26, 2009 [PDF]
- CDL releases "California Digital Library 2008 Profile" [PDF]
- University of California Libraries and Springer Sign Pilot Agreement for Open Access Journal Publishing. January 21, 2009 press release [PDF]
- Laine Farley has been named executive director of the CDL. December 5, 2008 press release [HTML]
- The UC libraries support the settlement between Google, the Authors Guild, and the Association of American Publishers. See the press release: October 28, 2008 [HTML]
- Frequently asked questions about how the settlement impacts libraries and users: October 28, 2008 [PDF]

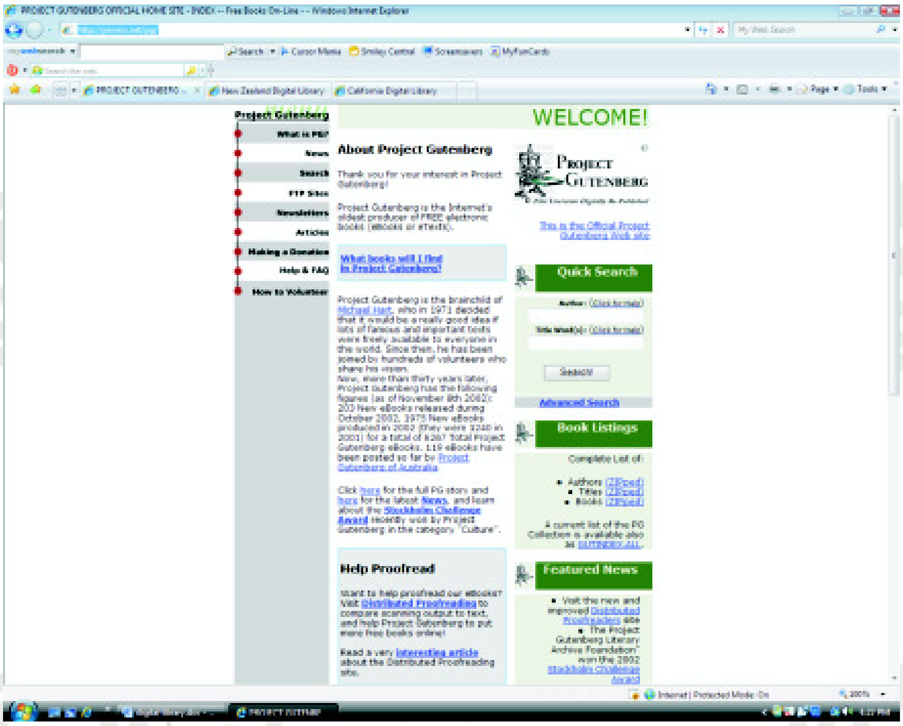
- **Google Digital Library of Alexandria**

  Google announced the library scanning project in December 2004. It has four library partners viz. Stanford University, Oxford University, New York Public Library and University of Michigan. The major publishing houses like McGraw-Hill and Penguin Group have sued Google for scanning books without permission.

  Reference:http://googlesystem.blogspot.com/2006/08/googles-digital-library-of-alexandria.html

- **Gutenberg** (http://promo.net/pg/)

  The project Gutenberg began in 1971 at the Materials Research Lab, the University of Illinois. The prime objective of this project was to facilitate the world's great literature to electronic versions for the public access.



PROJECT GUTENBERG OFFICIAL HOME SITE - INDEX -- Free Books On-Line -- Windows Internet Explorer

Project Gutenberg

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About Project Gutenberg

Thank you for your interest in Project Gutenberg!

Project Gutenberg is the Internet's oldest producer of FREE electronic books (eBooks or eTexts).

What books will I find in Project Gutenberg?

Project Gutenberg is the brainchild of Michael Hart, who in 1971 decided that it would be a really good idea if lots of famous and important texts were freely available to everyone in the world. Since then, he has been joined by hundreds of volunteers who share his vision.
Now, more than thirty years later, Project Gutenberg has the following figures (as of November 8th 2002): 203 New eBooks released during October 2002, 1975 New eBooks produced in 2002 (they were 3240 in 2001) for a total of 6267 Total Project Gutenberg eBooks. 119 eBooks have been posted so far by Project Gutenberg of Australia.

Click here for the full PG story and here for the latest News, and learn about the Stockholm Challenge Award recently won by Project Gutenberg in the category "Culture".

Help Proofread

Want to help proofread our eBooks? Visit Distributed Proofreading to compare scanning output to text, and help Project Gutenberg to put more free books online!

Read a very interesting article about the Distributed Proofreading site.

PROJECT GUTENBERG

This is the Official Project Gutenberg Web site

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Author: (Click for help)

Title Word(s): (Click for help)

Search

Advanced Search

Book Listings

Complete List of:

- Authors (ZIPped)
- Titles (ZIPped)
- Books (ZIPped)

A current list of the PG Collection is available also as GUTINDEX.ALL.

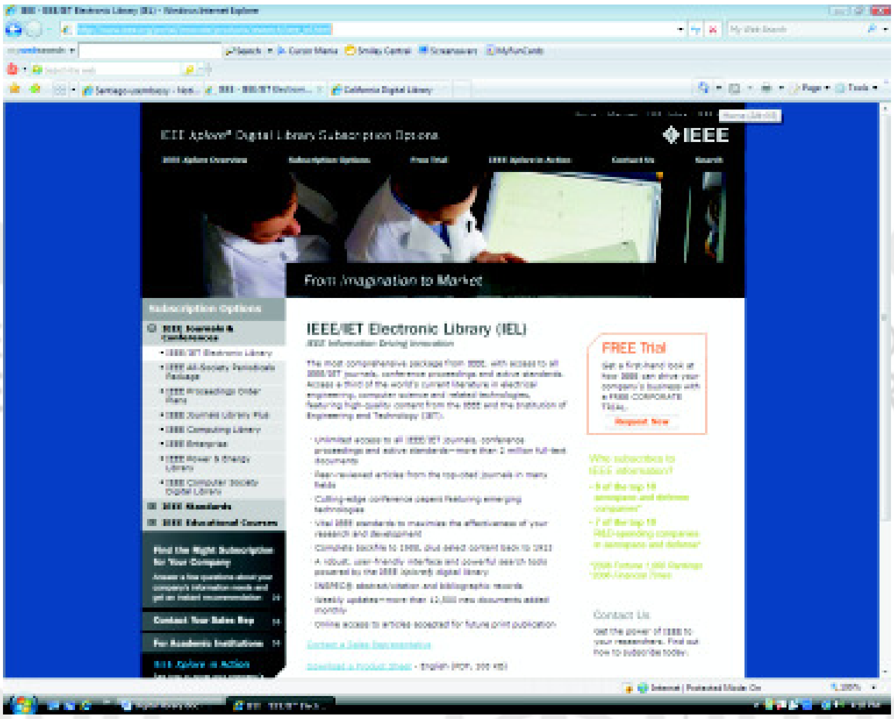
Featured News

- Visit the new and improved Distributed Proofreaders site
- The Project Gutenberg Literary Archive Foundation" won the 2002 Stockholm Challenge Award

- **The IEEE Electronic Library**

  (http://www.ieee.org/portal/innovate/products/research/ieee_iel.html)

  The IEEE digital library is the gateway to valuable, cutting-edge research, standards and educational courses with more than two million articles. It offers 100% full-text searchable content with full-page PDF images of all IEEE articles, papers and standards.



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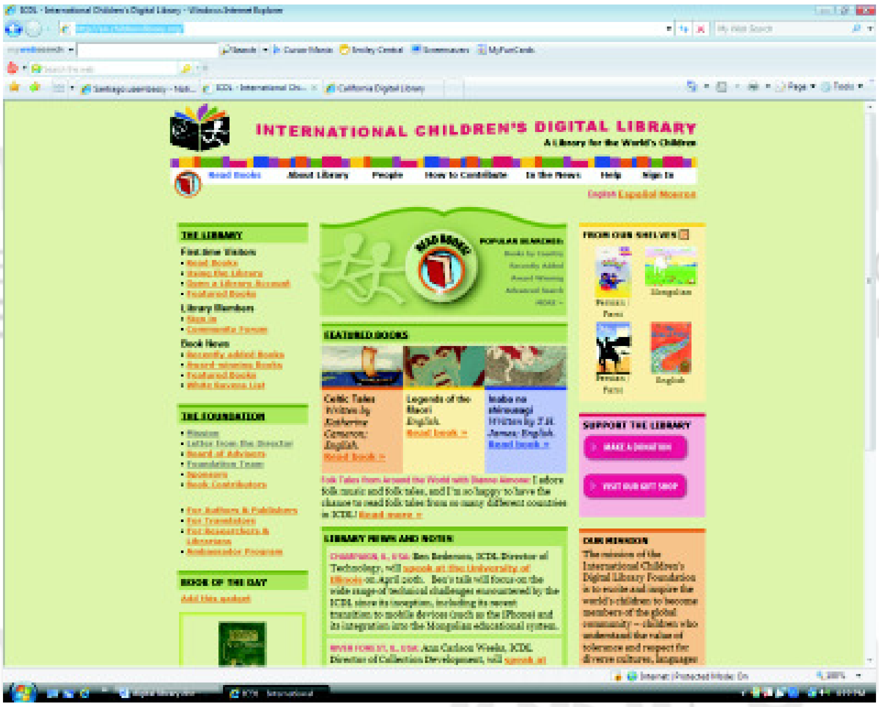
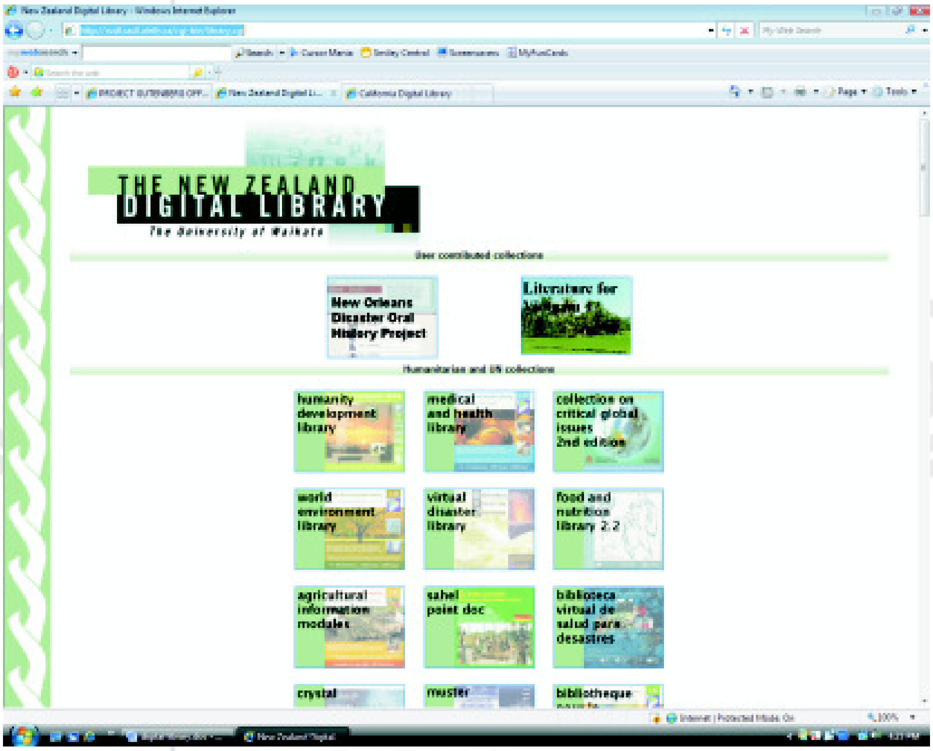
- **International Children’s Digital Library (ICDL)** (http://en.childrenslibrary.org/)

  The ICDL was created by an interdisciplinary research team at the University of Maryland in cooperation with the Internet Archives. This was established to create a collection of more than 10,000 books in at least 100 languages that is freely available to children, teachers, librarians, parents, and scholars throughout the world via the Internet.



- **The New Zealand Digital Library Project** (http://nzdl.sadl.uleth.ca/cgi-bin/library.cgi)

  The New Zealand Digital Library Project is a research programme at the University of Waikato. The main objective of this project is to develop the underlying technology for digital libraries and make it available publicly.


New Zealand Digital Library - Windows Internet Explorer
THE NEW ZEALAND
DIGITAL LIBRARY
The University of Waikato
User contributed collections
New Orleans Disaster Oral History Project
Literature for
Humanitarian and UN collections
humanity development library
medical and health library
collection on critical global issues 2nd edition
world environment library
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bibliotheque
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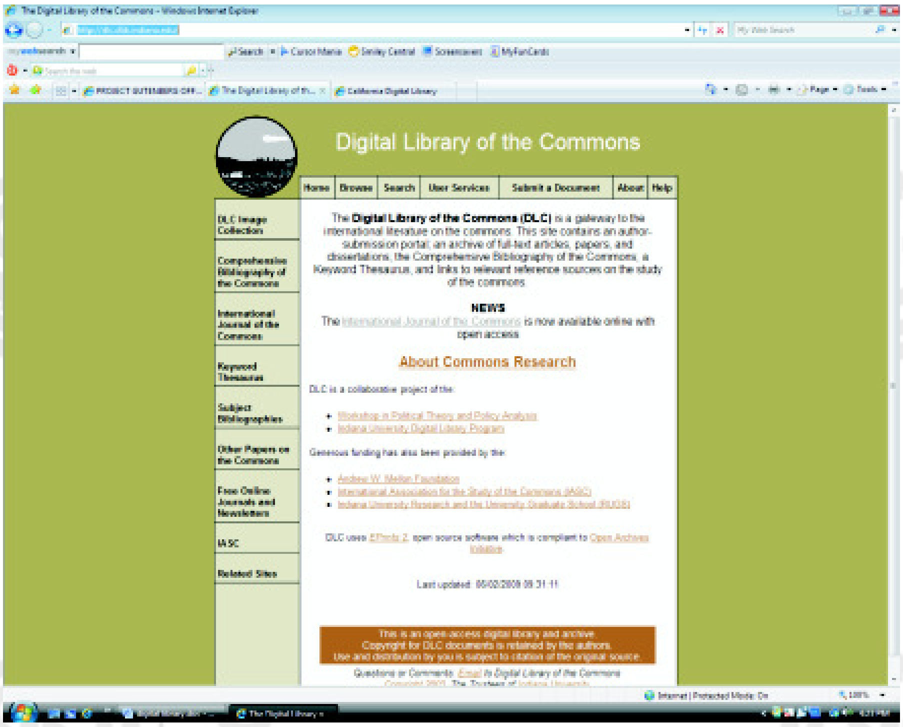
- **Digital Library of the Commons** (http://dlc.dlib.indiana.edu/)

  The Digital Library of the Commons (DLC) is running on Eprints2, which provides free access to an archive of international literature on the commons, common-pool resources and common property. Features for authors and readers include advanced searching; browsing by region, sector, and author name; an author submission portal for uploading a variety of document formats; and a service that uses email to alert subscribers to new documents in their area of interest.


The Digital Library of the Commons - Windows Internet Explorer
Digital Library of the Commons
Home
Browse
Search
User Services
Submit a Document
About
Help
DLC Image Collection
Comprehensive Bibliography of the Commons
International Journal of the Commons
Keyword Thesaurus
Subject Bibliographies
Other Papers on the Commons
Free Online Journals and Newsletters
IASC
Related Sites
Internet | Protected Mode: On
100%

The **Digital Library of the Commons (DLC)** is a gateway to the international literature on the commons. This site contains an author-submission portal, an archive of full-text articles, papers, and dissertations, the Comprehensive Bibliography of the Commons, a Keyword Thesaurus, and links to relevant reference sources on the study of the commons.

NEWS

The International Journal of the Commons is now available online with open access.

About Commons Research

DLC is a collaborative project of the:

- Workshop in Political Theory and Policy Analysis
- Indiana University Digital Library Program

Generous funding has also been provided by the:

- Andrew W. Mellon Foundation
- International Association for the Study of the Commons (IASC)
- Indiana University Research and the University Graduate School (RUGS)

DLC uses EPrints 2, open source software which is compliant to Open Archives Initiative.

Last updated: 05/02/2008 08:31:11

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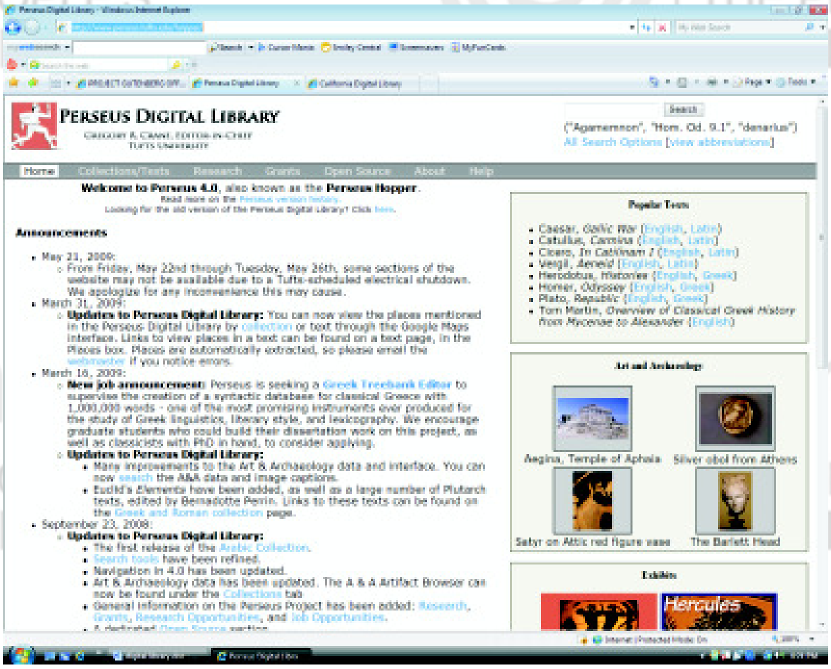
Copyright for DLC documents is retained by the authors.
Use and distribution by you is subject to citation of the original source.

Questions or Comments: Email to Digital Library of the Commons
Copyright 2003, The Trustees of Indiana University

- **Perseus Digital Library** (http://www.perseus.tufts.edu/hopper/)

  Perseus is an evolving digital library, to bring a wide range of source materials to as large as audience as possible.



PERSEUS DIGITAL LIBRARY
GREGORY R. CRANE, EDITOR-IN-CHIEF
TUFTS UNIVERSITY

("Agamemnon", "Hom. Od. 9.1", "denarius")
All Search Options [view abbreviations]

Welcome to Perseus 4.0, also known as the **Perseus Hopper**.
Read more on the Perseus version history.
Looking for the old version of the Perseus Digital Library? Click here.

Announcements

- May 21, 2009:
  - From Friday, May 22nd through Tuesday, May 26th, some sections of the website may not be available due to a Tufts-scheduled electrical shutdown. We apologize for any inconvenience this may cause.
- March 31, 2009:
  - **Updates to Perseus Digital Library:** You can now view the places mentioned in the Perseus Digital Library by collection or text through the Google Maps interface. Links to view places in a text can be found on a text page, in the Places box. Places are automatically extracted, so please email the webmaster if you notice errors.
- March 16, 2009:
  - **New job announcement:** Perseus is seeking a Greek Treebank Editor to supervise the creation of a syntactic database for classical Greece with 1,000,000 words - one of the most promising instruments ever produced for the study of Greek linguistics, literary style, and lexicography. We encourage graduate students who could build their dissertation work on this project, as well as classicists with PhD in hand, to consider applying.
  - **Updates to Perseus Digital Library:**
    - Many improvements to the Art & Archaeology data and interface. You can now search the A&A data and image captions.
    - Euclid's *Elements* have been added, as well as a large number of Plutarch texts, edited by Bernadotte Perrin. Links to these texts can be found on the Greek and Roman collection page.
- September 23, 2008:
  - **Updates to Perseus Digital Library:**
    - The first release of the Arabic Collection.
    - Search tools have been refined.
    - Navigation in 4.0 has been updated.
    - Art & Archaeology data has been updated. The A & A Artifact Browser can now be found under the Collections tab
    - General information on the Perseus Project has been added: Research, Grants, Research Opportunities, and Job Opportunities.
    - A dedicated Open Source section

Popular Texts

- Caesar, *Gallic War* (English, Latin)
- Catullus, *Carmina* (English, Latin)
- Cicero, *In Catilinam I* (English, Latin)
- Vergil, *Aeneid* (English, Latin)
- Herodotus, *Histories* (English, Greek)
- Homer, *Odyssey* (English, Greek)
- Plato, *Republic* (English, Greek)
- Tom Martin, *Overview of Classical Greek History from Mycenae to Alexander* (English)

Art and Archaeology

Exhibits

- **The German Digital Library Programme GLOBAL INFO**

  The German Digital Library Programme GLOBAL INFO is funded by the federal ministry for education and research from 1998. The main objective of this initiative is to provide optimal access to the world-wide electronic and multimedia information on full texts, literature references, factual databases and software.

  Reference: http://dlib.anu.edu.au/dlib/april99/04rusch-feja.html

- **The Sydney Electronic Text and Image Service (SETIS)**

  (http://setis.library.usyd.edu.au/)

  SETIS was launched in 1995at the University of Sydney. It provides access to a large number of networked and in-house full text databases. It also engaged in a number of text and image creation projects.

SETIS Home Page - Windows Internet Explorer
SETIS Home Page
California Digital Library
The University of Sydney

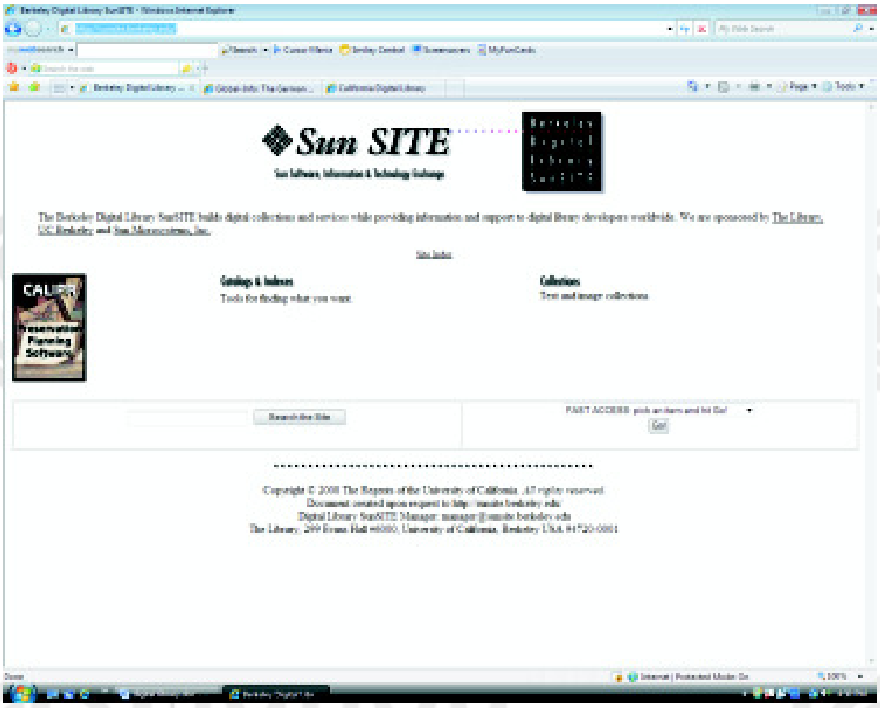
SETIS

The Sydney Electronic Text and Image Service

[illegible]

- **The Berkeley Digital Library** (http://sunsite.berkeley.edu/)

  The Berkeley Digital Library project began as an inter-agency, academic teaming to research collaboration techniques. It continues and in currently developing the tools and technologies to support highly improved models of the "scholarly information life cycle". The goal is to facilitate the move from the current centralized, discrete publishing model, to a distributed continuous, and self-publishing model. It provide access to a large variety of scholarly publications.


Berkeley Digital Library SunSITE - Windows Internet Explorer
Sun SITE
Sun Software, Information & Technology Exchange
Berkeley Digital Library SunSITE
CALIPR Preservation Planning Software

The Berkeley Digital Library SunSITE builds digital collections and services while providing information and support to digital library developers worldwide. We are sponsored by The Library, UC Berkeley and Sun Microsystems, Inc.

Site Index

Catalogs & Indexes
Tools for finding what you want

Collections
Text and image collections

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FAST ACCESS: pick an item and hit Go! Go!

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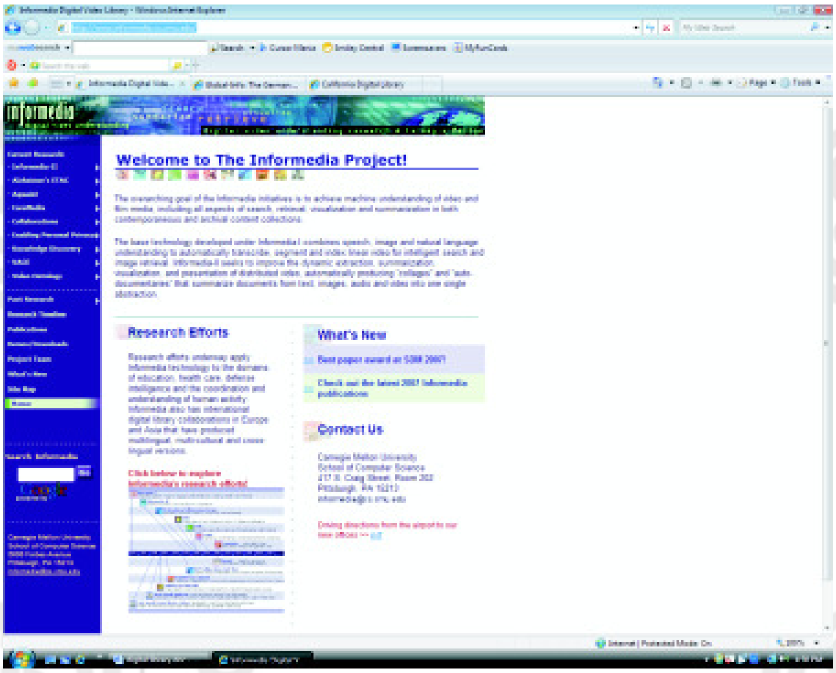
Document created upon request to http://sunsite.berkeley.edu
Digital Library SunSITE Manager: manager@sunsite.berkeley.edu
The Library, 299 Evans Hall #6000, University of California, Berkeley USA 94720-6001

- **Informedia Digital Video Library** (http://www.informedia.cs.cmu.edu/)

  This is a project at Carnegie Mellon University and the overarching goal of the Informedia initiative is to achieve machine understanding of video and film media, including all aspects of search, retrieval, visualization and summarization in both contemporaneous and archival content collections. The Informedia-II seeks to improve the dynamic extraction, summarization, visualization and presentation of distributed video.



Welcome to The Informedia Project!

The overarching goal of the Informedia initiatives is to achieve machine understanding of video and film media, including all aspects of search, retrieval, visualization and summarization in both contemporaneous and archival content collections.

The base technology developed under Informedia-I combines speech, image and natural language understanding to automatically transcribe, segment and index linear video for intelligent search and image retrieval. Informedia-II seeks to improve the dynamic extraction, summarization, visualization, and presentation of distributed video, automatically producing "collages" and "auto-documentaries" that summarize documents from text, images, audio and video into one single abstraction.

Research Efforts

Research efforts underway apply Informedia technology to the domains of education, health care, defense intelligence and the coordination and understanding of human activity. Informedia also has international digital library collaborations in Europe and Asia that have produced multilingual, multicultural and cross-lingual versions.

Click below to explore Informedia's research efforts!

What's New

Best paper award at SDM 2007

Check out the latest 2007 Informedia publications

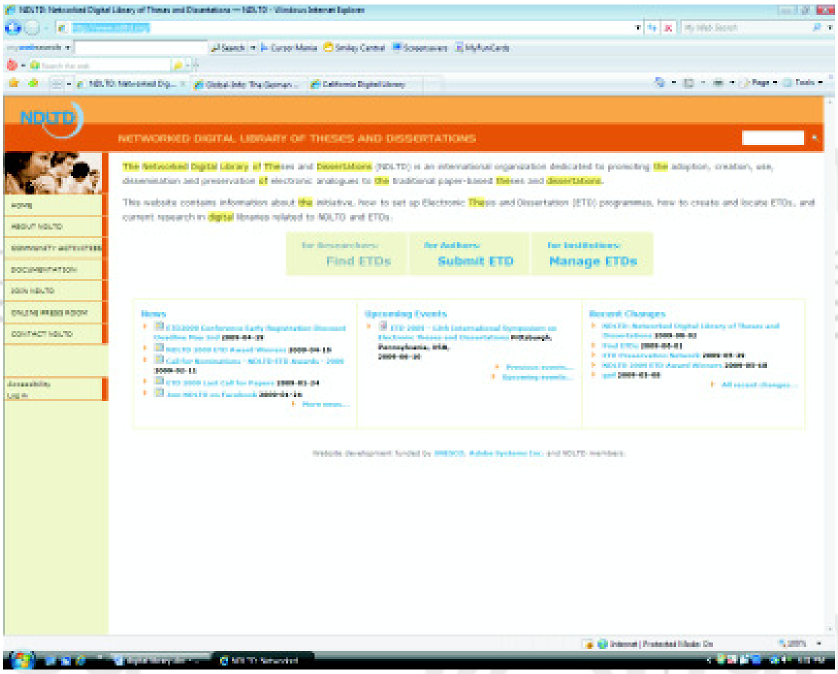
Contact Us

Carnegie Mellon University
School of Computer Science
417 S. Craig Street, Room 202
Pittsburgh, PA 15213
informedia@cs.cmu.edu

Driving directions from the airport to our new offices >>

- **The Networked Digital Library of Theses and Dissertations (NDLTD)** (http://www.ndltd.org/)

  The Networked Digital Library of Theses and Dissertations is an international organisation dedicated to promoting the adoption, creation, use, dissemination and preservation of electronic analogueues to the traditional paper-based theses and dissertations. This contains information about the initiative, how to set up Electronic Thesis and Dissertation (ETD) programmes, how to create and locate ETDs, and current research in digital libraries related to NDLTD and ETDs.



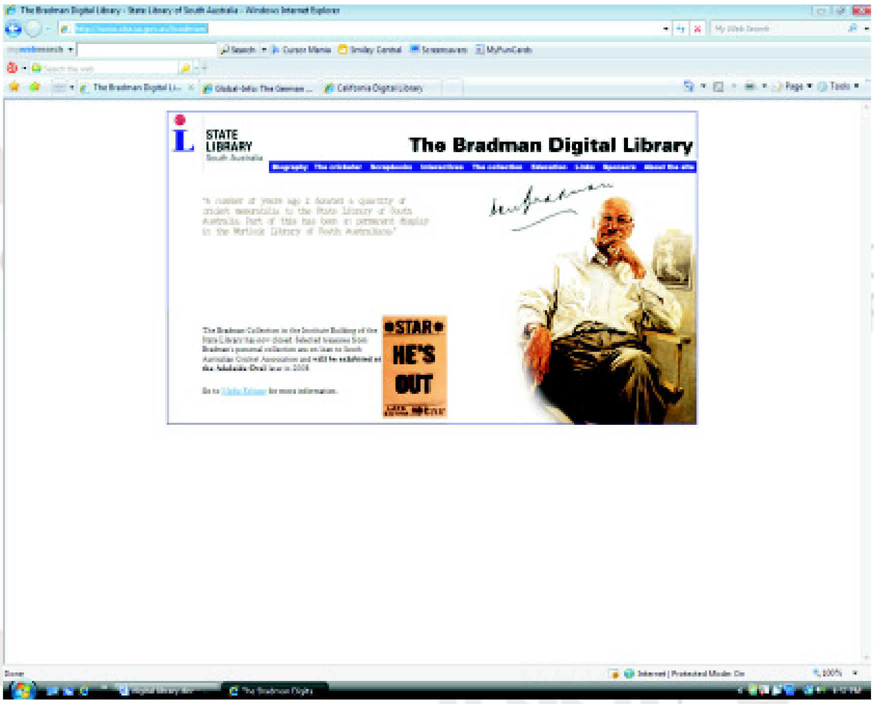
The Networked Digital Library of Theses and Dissertations (NDLTD) is an international organization dedicated to promoting the adoption, creation, use, dissemination and preservation of electronic analogues to the traditional paper-based theses and dissertations.

This website contains information about the initiative, how to set up Electronic Thesis and Dissertation (ETD) programmes, how to create and locate ETDs, and current research in digital libraries related to NDLTD and ETDs.

Website development funded by UNESCO, Adobe Systems Inc. and NDLTD members.

- **The Bradman Digital Library, Australia** (http://www.slsa.sa.gov.au/bradman/)

  This digital library was created to give world wide access to collection of memorabilia devoted to Sir Don Bradman and held by the Mortlock State Library of South Australia. It contains biographical information about Bradman, a digital exhibition of artifacts, and a series of scrapbooks covering the years 1925-26 to 1948-49, containing press cuttings, notes and photographs.



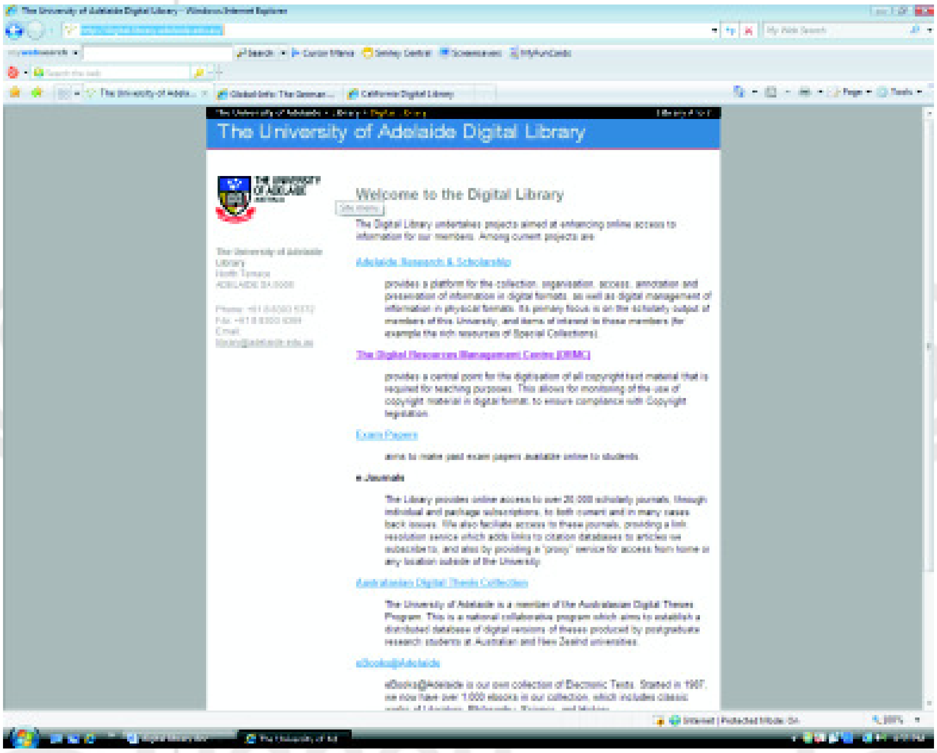
"A number of years ago I donated a quantity of cricket memorabilia to the State Library of South Australia. Part of this has been in permanent display in the Mortlock Library of South Australiana."

The Bradman Collection in the Institute Building of the State Library has now closed. Selected treasures from Bradman's personal collection are on loan to South Australian Cricket Association and will be exhibited at the Adelaide Oval later in 2008.

Go to [illegible] for more information.

- **The University of Adelaide Digital Library** (http://digital.library.adelaide.edu.au/)

  The Digital Library undertakes projects aimed at enhancing online access to information for their members. This provides access to exam papers available online, Australian digital theses collection and e-books available at Adelaide.



The University of Adelaide Digital Library

Welcome to the Digital Library

The Digital Library undertakes projects aimed at enhancing online access to information for our members. Among current projects are:

The University of Adelaide Library
North Terrace
ADELAIDE SA 5005

Phone: +61 8 8303 5372
Fax: +61 8 8303 4369
Email: library@adelaide.edu.au

Adelaide Research & Scholarship

provides a platform for the collection, organisation, access, annotation and preservation of information in digital formats, as well as digital management of information in physical formats. Its primary focus is on the scholarly output of members of this University, and items of interest to these members (for example the rich resources of Special Collections).

The Digital Resources Management Centre (DRMC)

provides a central point for the digitisation of all copyright text material that is required for teaching purposes. This allows for monitoring of the use of copyright material in digital format, to ensure compliance with Copyright legislation.

Exam Papers

aims to make past exam papers available online to students.

e-Journals

The Library provides online access to over 20,000 scholarly journals, through individual and package subscriptions, to both current and in many cases back issues. We also facilitate access to these journals, providing a link resolution service which adds links to citation databases to articles we subscribe to, and also by providing a "proxy" service for access from home or any location outside of the University.

Australasian Digital Thesis Collection

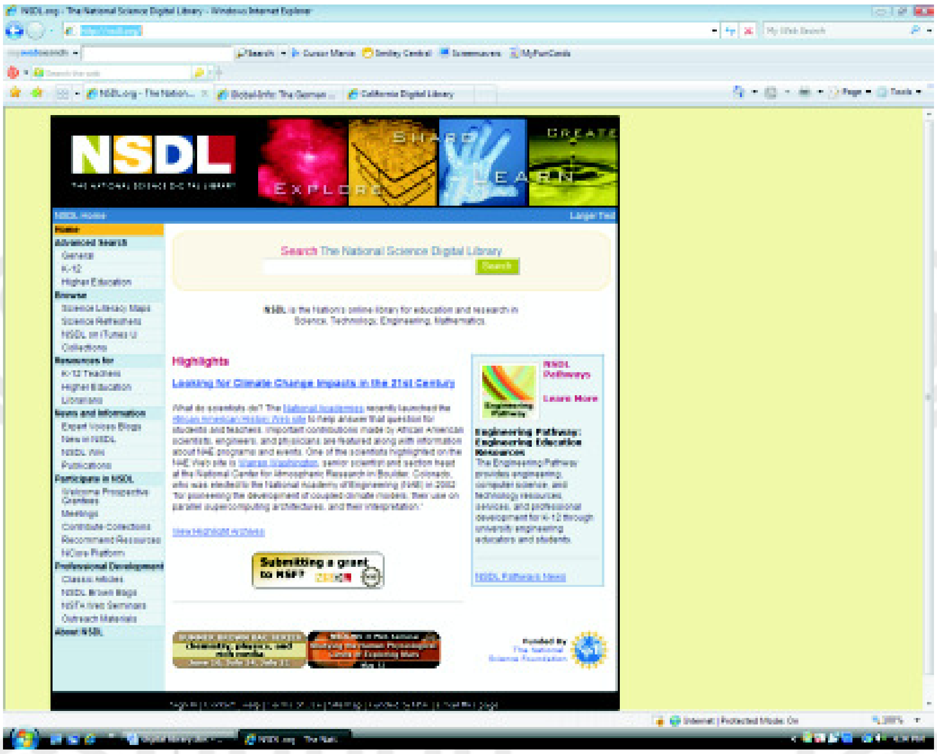
The University of Adelaide is a member of the Australasian Digital Theses Program. This is a national collaborative program which aims to establish a distributed database of digital versions of theses produced by postgraduate research students at Australian and New Zealand universities.

eBooks@Adelaide

eBooks@Adelaide is our own collection of Electronic Texts. Started in 1997, we now have over 1,000 ebooks in our collection, which includes classic works of Literature, Philosophy, Science, and History.

- **National Science Foundation Digital Library** (http://nsdl.org/)

  The National Science Foundation Digital Library at the University of Texas at Austin is a dynamic archive of information on digital morphology and high-resolution X-ray computed tomography of biological specimens.



NSDL is the Nation's online library for education and research in Science, Technology, Engineering, Mathematics.

Highlights

Looking for Climate Change Impacts in the 21st Century

What do scientists do? The National Academies recently launched the African American History Web site to help answer that question for students and teachers. Important contributions made by African American scientists, engineers, and physicians are featured along with information about NAE programs and events. One of the scientists highlighted on the NAE Web site is Warren Washington, senior scientist and section head at the National Center for Atmospheric Research in Boulder, Colorado, who was elected to the National Academy of Engineering (NAE) in 2002 "for pioneering the development of coupled climate models, their use on parallel supercomputing architectures, and their interpretation."

View Highlight Archives

NSDL Pathways

Learn More

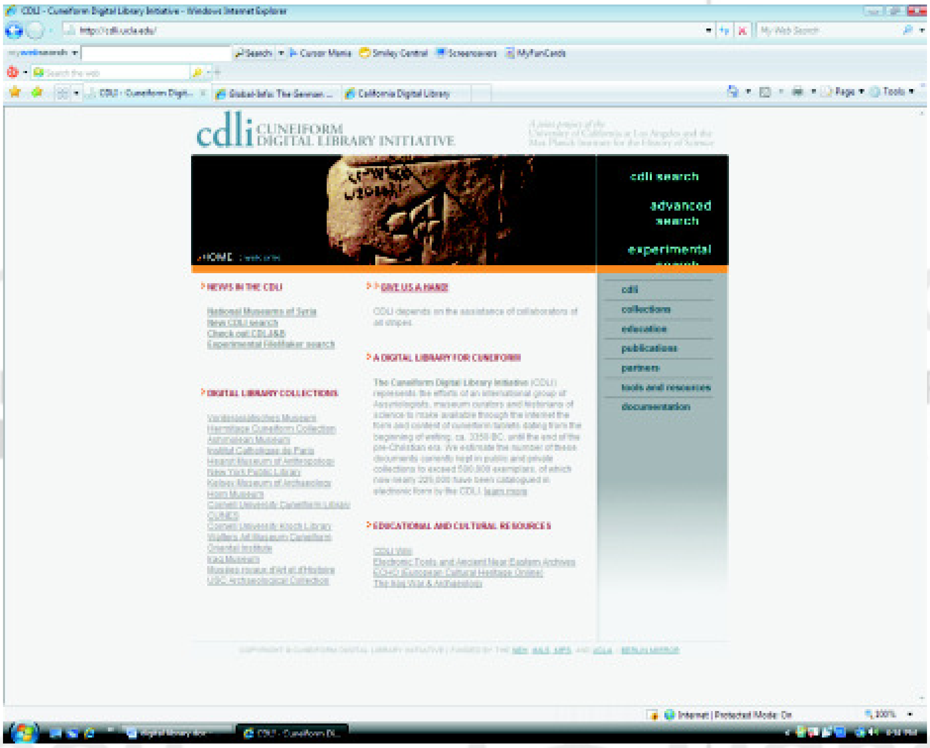
Engineering Pathway: Engineering Education Resources

The Engineering Pathway provides engineering, computer science, and technology resources, services, and professional development for K-12 through university engineering educators and students.

NSDL Pathways News

- **The Cuneiform Digital Library Initiative (CDLI) (http://cdli.ucla.edu/)**

  The Cuneiform Digital Library initiative represents the efforts of an international group of Assyriologists, museum curators and historians of science to make available through the internet the form and content of cuneiform tablets dating from the beginning of writing until the end of the pre-Christian era.



cdli CUNEIFORM DIGITAL LIBRARY INITIATIVE

A joint project of the University of California at Los Angeles and the Max Planck Institute for the History of Science

NEWS IN THE CDLI

National Museums of Syria
New CDLI search
Check out CDLI:A&B
Experimental FileMaker search

DIGITAL LIBRARY COLLECTIONS

Vorderasiatisches Museum
Hermitage Cuneiform Collection
Ashmolean Museum
Institut Catholique de Paris
Hearst Museum of Anthropology
New York Public Library
Kelsey Museum of Archaeology
Horn Museum
Cornell University Cuneiform Library
CUNES
Cornell University Kroch Library
Walters Art Museum Cuneiform
Oriental Institute
Iraq Museum
Musées royaux d'Art et d'Histoire
USC Archaeological Collection

GIVE US A HAND

CDLI depends on the assistance of collaborators of all stripes.

A DIGITAL LIBRARY FOR CUNEIFORM

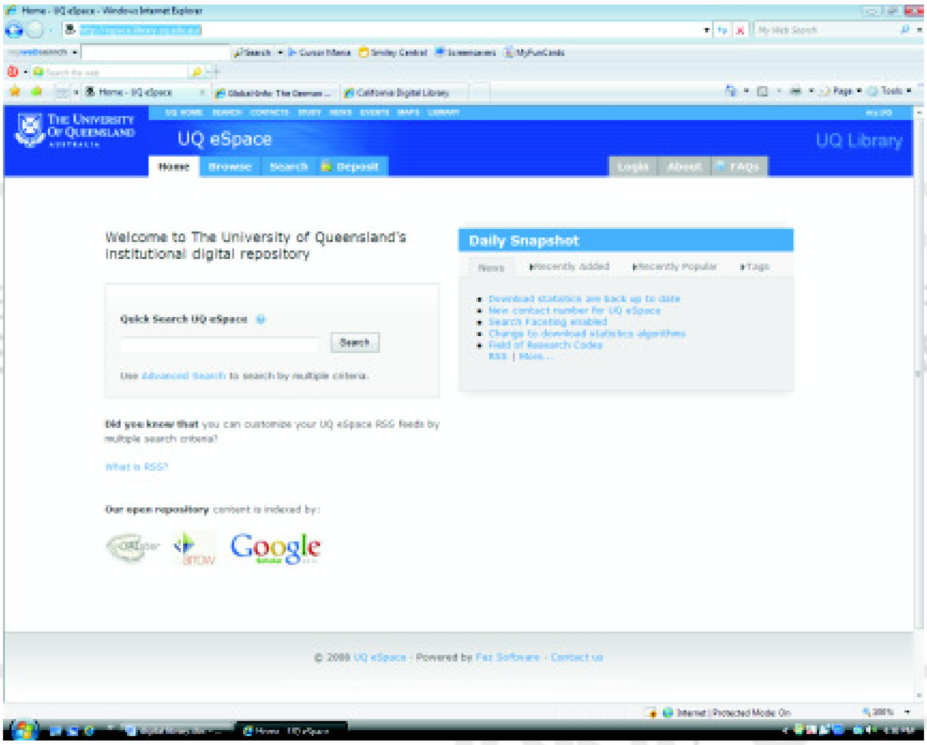
The Cuneiform Digital Library Initiative (CDLI) represents the efforts of an international group of Assyriologists, museum curators and historians of science to make available through the internet the form and content of cuneiform tablets dating from the beginning of writing, ca. 3350 BC, until the end of the pre-Christian era. We estimate the number of these documents currently kept in public and private collections to exceed 500,000 exemplars, of which now nearly 225,000 have been catalogued in electronic form by the CDLI. learn more

EDUCATIONAL AND CULTURAL RESOURCES

CDLI Wiki
Electronic Tools and Ancient Near Eastern Archives
ECHO (European Cultural Heritage Online)
The Iraq War & Archaeology

- **UQ eSpace** (http://espace.library.uq.edu.au/)

  UQ eSpace is the University of Queensland's institutional digital repository for publications, research, and teaching materials. Deposited material covers a very wide range of subjects and disciplines. This also holds the electronic full text of many peer-reviewed published articles and conference papers, book chapters, theses and other forms of written research from UQ academic staff and students.



Welcome to The University of Queensland's institutional digital repository

Quick Search UQ eSpace

Use Advanced Search to search by multiple criteria.

Did you know that you can customize your UQ eSpace RSS feeds by multiple search criteria?

What is RSS?

Our open repository content is indexed by:

Daily Snapshot

News ▸Recently Added ▸Recently Popular ▸Tags

- Download statistics are back up to date
- New contact number for UQ eSpace
- Search Faceting enabled
- Change to download statistics algorithms
- Field of Research Codes

RSS | More...

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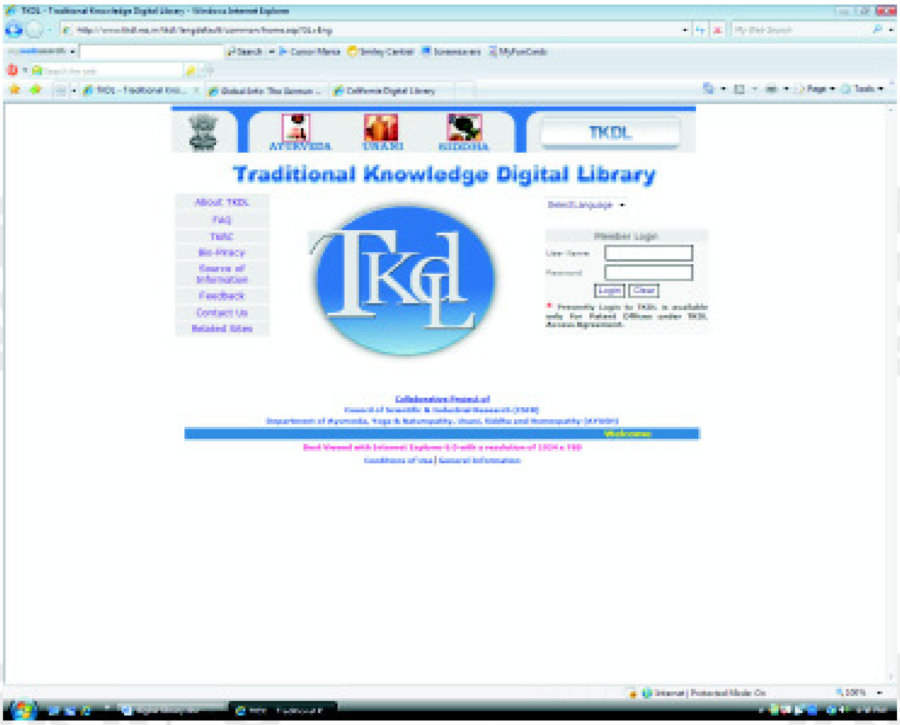
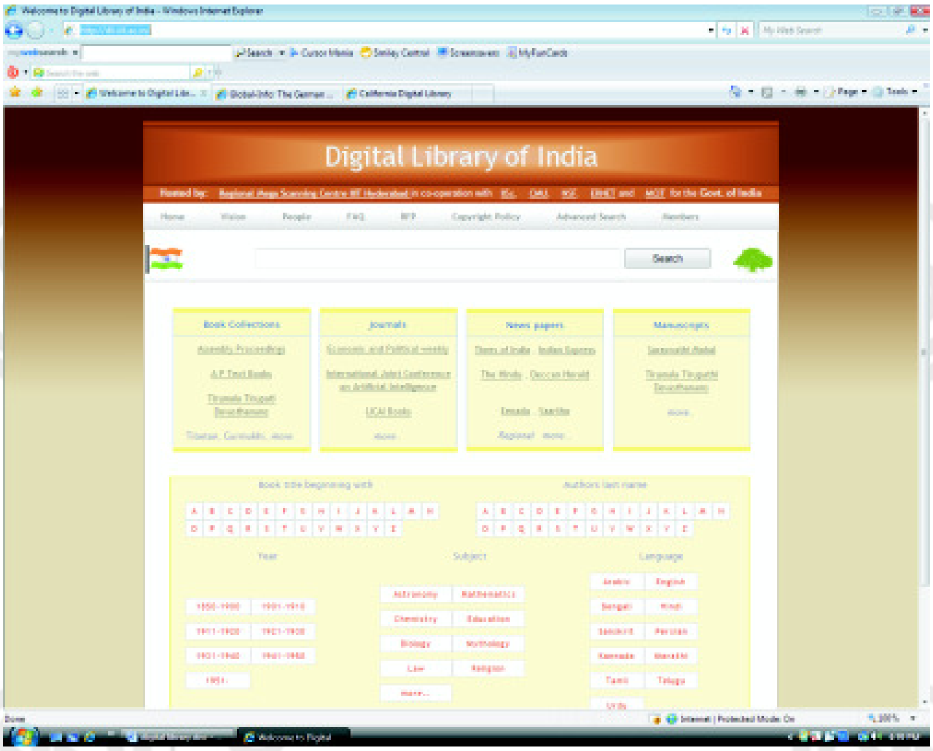
- **Traditional Knowledge Digital Library** (http://www.tkdl.res.in/tkdl/langdefault/common/home.asp?GL=Eng)

  The Traditional Knowledge Digital Library is a well known Indian digital library initiative being implemented by the National Institute of Science Communication and Information Resources (NISCAIR). The major objective is to provide information on the Indian system of medicine such as Ayurveda, Unani, Siddha, Yoga, Naturopathy and Tribal Medicine.



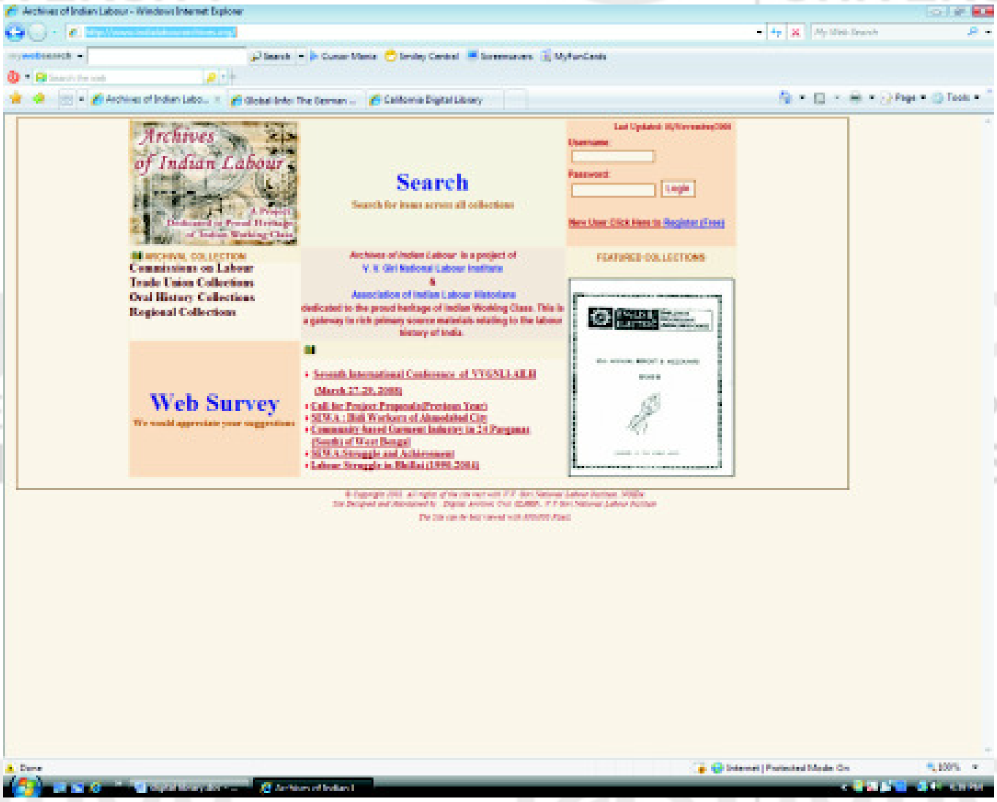
- **The Digital Library of India (DLI)** (http://dli.iiit.ac.in/)

  The Digital Library of India is the greatest digital library initiative in the country. DLI is a part of Universal Digital Library (UDL) and Million Books Projects, coordinated by the Carnegie Mellon University, USA.



- **The Archives of Indian Labour** (http://www.indialabourarchives.org/)

  The Archives of Indian Labour is a collaborative project of V.V.Giri National Labour Institute and the Association of Indian Labour Historians. The main objective is to preserve and make accessible archival documents on the working class of India.



Archives of Indian Labour – Windows Internet Explorer

Archives of Indian Labour

A Project Dedicated to Proud Heritage of Indian Working Class

Search

Search for items across all collections

Last Updated: 10/November/2008

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New User: Click Here to Register (Free)

ARCHIVAL COLLECTION

Commissions on Labour

Trade Union Collections

Oral History Collections

Regional Collections

Archives of Indian Labour is a project of V. V. Giri National Labour Institute & Association of Indian Labour Historians dedicated to the proud heritage of Indian Working Class. This is a gateway to rich primary source materials relating to the labour history of India.

FEATURED COLLECTIONS

Web Survey

We would appreciate your suggestions

- Seventh International Conference of VVGNLI-AILH (March 27-29, 2008)
- Call for Project Proposals(Previous Year)
- SEWA : Bidi Workers of Ahmedabad City
- Community based Garment Industry in 24 Parganas (South) of West Bengal
- SEWA Struggle and Achievement
- Labour Struggle in Bhilai (1990-2001)

Search
Cursor Mania
Smiley Central
Screensavers
MyFunCards
Global Info: The German ...
California Digital Library
Page
Tools
Done
Internet | Protected Mode: On
100%

5.5 FUTURE TRENDS

Although the term digital library is used widely in the literature, a new term, 'hybrid library', appeared in the course of digital library research in the UK. A hybrid library has been defined as a library where digital and printed information resources co-exist and are brought together in an integrated information service accessible locally as well as remotely (HyLife, 2002a). A number of researcher believe that for the foreseeable future we shall live in the world of hybrid libraries that will integrate traditional libraries with the emerging digital ones (for example, Oppenheim and Smithson, 1999; Pinfield et al., 1998; Rusbridge, 1998). Pinfield at al. (1998) comment that the hybrid library is on the continuum between the conventional and digital library, where electronic and paper-based information sources are used alongside each other. Rusbridge (1998) suggests that a hybrid library brings a range of technologies from different sources together, and integrates systems and services in both the electronic and print environments. He further argues that 'the name hybrid library is intended to reflect the transitional state of the library, which today can neither be fully print not fully digital'.

There are numerous areas of research related to the historic interests of the digital library community that are at the crossroads of technology and social science and which will demand investment and attention in the coming years; many of these are natural extensions and elaborations of the collaborations initiated by the past decade of digital library research programs. Below mentioned are some of the driving force areas for future of digitisation

- Personal information management. As more and more of the activities in our lives are captured, represented and stored in digital form, the questions of how we organize, manage, share, and preserve these digital representations will become increasingly crucial. Among the trends lending urgency to this research area are the development of digital medical records (in the broadest sense), e-portfolios in the education environment, the overall shift of communications to email, and the amassing of very large personal collections of digital content (text, images, video, sound recordings, etc.)

- Long term relationships between humans and information collections and systems. This is related to personal information management, but also considers evolutionary characteristics of behaviour, systems that learn, personalization, system to system migration across generations of technologies, and similar questions. This is connected to human-computer interface studies and also to studies of how individuals and groups seek, discovers, use and share information, but goes beyond the typical concerns of both to take a very long time horizon perspective.

- Role of digital libraries, digital collections and other information services in supporting teaching, learning, and human development. The analysis here needs to be done not on a relatively transactional basis (i.e. how can a given system support achievement of a specific curricular goal in seventh grade mathematics) but how information resources and services can be partners over development and learning that spans an entire human lifetime, from early childhood to old age.

- Active environments for computer supported collaborative work offer the starting point for another research program. These environments are called for, under the term "colaboratories", by the various cyber infrastructure and e-science programs, but have much more general applicability for collaboration and social interactions. From one perspective, these environments are natural extensions of digital library environments, but at least some sectors of the digital library community have always found active work environments to be an uncomfortable fit with the rather passive tradition of libraries; perhaps here the baggage of "digital libraries" as the disciplinary frame is less than helpful. But there is a rich research agenda that connects literatures and evidence with authoring, analysis and re-use in a much more comprehensive way than we have done to date; this would consider, for example, the interactions between the practices of scholarly authoring and communication on one hand, and on the other, the shifting practices of scholarship that are being recognized and accelerated by investments in e-science and e-research.

5.6 SUMMARY

Libraries have always played a significant role in society, and digital libraries with the promise of breaking the barriers of geographical distance, language and culture, have a potentially even more significant social role. Digital libraries will not only change our reading and information use habits, they are also going to bring major changes in the economic models of information generation, distribution and management functions.

A tremendous amount of research and development activity has gone into the study of digital libraries. Many issues have been addressed and problems have been partly or fully resolved. Researchers from a variety of disciplines, such as library and information science, computer science and engineering, social sciences and humanities are working closely together to look into the myriad of unresolved issues.

For exploiting the benefits of Digital Library in Indian languages there is urgent need of tools and applications such as OCRs and Machine Translation systems so that user can take benefit of reading rare classics published in any language and researchers are able to use these tools for their linguistic research. This parallel aligned corpus development is first attempt in context of Indian languages. This is the initiation of several efforts which will follow the trend of enhancing the research in the field of Computational Linguistics. The parallel corpus as a Translation Memory (TM) will be a valuable source in improving the translation system and translators' efficiency.

It will boost the development of Lexical and Terminology databases with the combination of Quantitative and Qualitative Analysis of Text. Text Analyzer is a new kind of tool which is helpful in lexicography, knowledge acquisition, language and writing variation studies. Digital libraries creation have been a good test bed for OCR's and now that the world is moving towards speech to speech translation all these tools together will help building one for Indian languages.

5.7 ANSWERS TO SELF CHECK EXERCISES

1) Three general characteristics of the digital library of the future are:

   - A comprehensive collection of resources important for Scholarship, teaching, and learning
   - Readily accessible to all types of users
   - Managed and maintained by professionals.

2) Digital libraries can be classified broadly into:

   - early digital libraries, e.g. ELINOR, Gutenberg
   - digital libraries of institutional publications, e.g. ACM, IEL
   - digital library developments at national libraries, e.g. the British Library, Library of Congress (THOMAS), Digital Library of Canada
   - digital libraries at universities, e.g. Berkeley Digital Library SunSITE Bodleian Library Digital Library Projects, California Digital Library, DIGILIB, iGEMS and SETIS
   - digital libraries of special materials, e.g. Alexandria, Informedia, Grainger Engineering Library
   - digital libraries as research projects, e.g. GDL, NCSTRL, NDLTD
   - digital libraries as hybrid library projects, e.g., HeadLine.

5.8 KEYWORDS

Hybrid library : Libraries containing a mix of traditional print library resources and the growing number of electronic resources.

OCR : Optical Character Recognition, or OCR, is a technology that enables you to convert different types of documents, such as scanned paper documents, PDF files or images captured by a digital camera into editable and searchable data.

Open Knowledge Initiative : The Open Knowledge Initiative (O.K.I.) is an open and extensible architecture for learning technology specifically targeted to the needs of the higher education community.

Open Source Movement : A broad-reaching movement of individuals who support the use of open source licences for some or all software. Open source software is made available for anybody to use or modify, as its source code is made available.

5.9 REFERENCES AND FURTHER READING

Chowdhury, G G and Chowdhury, Sudatta, (2003) "*Introduction to Digital Libraries*", Facet Publishing, UK. Print

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http://www.dlib.org/dlib/july05/lynch/07lynch.html

Oppenheim C and Smithson D. (1999) What is the hybrid library*? Journal of Information Science* 25(2):97–112.

Pinfield, Stephen [et al] (1998). "Realizing the Hybrid Library" In *D-Lib Magazine*, October URL:http://mirrored.ukoln.ac.uk/lis-journals/dlib/dlib/dlib/october98/10pinfield.html

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Wilensky, R. (2000), Digital library resources as a basis for collaborative work. *J. Am. Soc. Inf. Sci.*, 51: 228–245.

UNIT 6 DIGITISATION PROCESS

Structure

6.0 OBJECTIVES

After going through this Unit, you will be able to:

- Understand the digitisation process of text, audio and video;
- Know different types of file formats; and
- Explain the file compression process.

6.1 INTRODUCTION

A digital library may contain materials that are born digital, such as e-journals and e-books, or may contain materials that were originally produced in another form but subsequently digitised. The process of digitising materials involves different steps depending upon material, technology and requirement. Various technical issues, like hardware and software, file formats and file compression and then the post processing requirements for making the digitised file accessible to end-user will be discussed.

6.2 DIGITISATION OF PRINT BASED DOCUMENTS

Once you have taken decision as to what needs to be digitised, the first step is to capture the documents available in print or analogue form for conversion into digital form. In the case of print based material, it is the hard copy of the document which needs to be scanned and digitised. The hard copy can be a paper based document, microforms or projection slides. For audio/ video media conversion is done from the analogue form to digital formats. Capturing devices for print based material include scanners and digital cameras attached with a computer. For audio/ video material appropriate players like music system or VHS players attached with a computer will be required. The computer that you use must have appropriate audio/ video capture cards in it.

6.2.1 Capturing Print Based Document

For converting hard copies into machine readable form there are three options available for a library:

1) Keying in the text

2) Scanning and capturing them as image files

3) OCR the files

Fresh keying in costs ten times more than scanning and saving as image files. However, if you are converting them into OCR, then some costs will be involved in error correction and editing.

Scanning technology has improved considerably over the years in terms of speed and resolution. There are several types of scanning devices available in the market now. Scanners come in three broad price ranges: i) low cost flatbed scanners or hand held devices, ii) low end sheet feeder type, iii) high end professional or book scanners. Scanning machines are generally based on Charge Couple Device (CCD) technology. In low end devices Contact Image sensor (CIS) technology is used generally whereas in some high end devices Photo Multiplier Tube (PMT) technology is used. PMT based drum scanners produce very high quality images which come at a high cost. CMOS (Complementary Metal Oxide Semiconductor) is another sensing technology that is used in hand held digital cameras.

The scanners operate by shining light on the document and directing the reflected light through a series of mirrors and lenses onto photo sensitive element. The photo sensitive element could be CCD, CIS or PMT based technology depending on the type of the scanners. Light sensitive photosites arrayed along the photosensitive element are converted into electronic signals which finally processed into digital image.

Self Check Exercise

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

1) Enumerate three options for converting hard copies into machine readable form.

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The **steps for scanning** a document

Step 1: Place the document on the scanner bed

Here we show the process using the Konica Minolta PS 7000 book scanner, which is a superior system for scanning large-sized books, artwork, ledgers and other bound materials. It is a face-up scanning system.

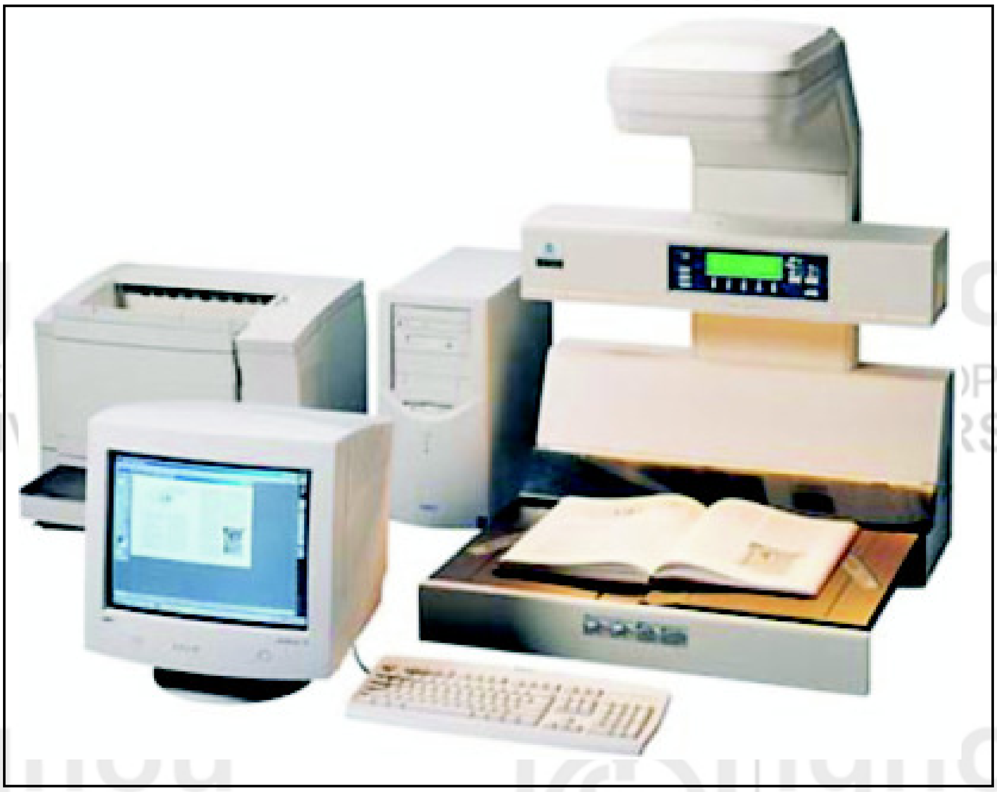
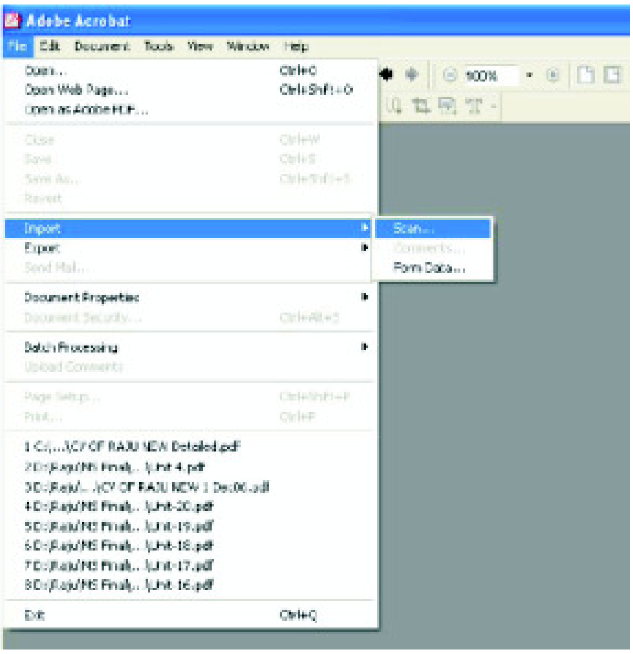


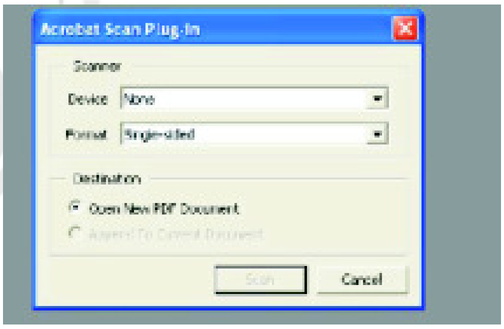
Fig. 6.1: Book Scanner

Step 2: Open the Adobe Acrobat

Click on **File>>Import>>Scan...**



Fill in the information for device, format and destination in the dialogue box that appears



Scanner

Device: None

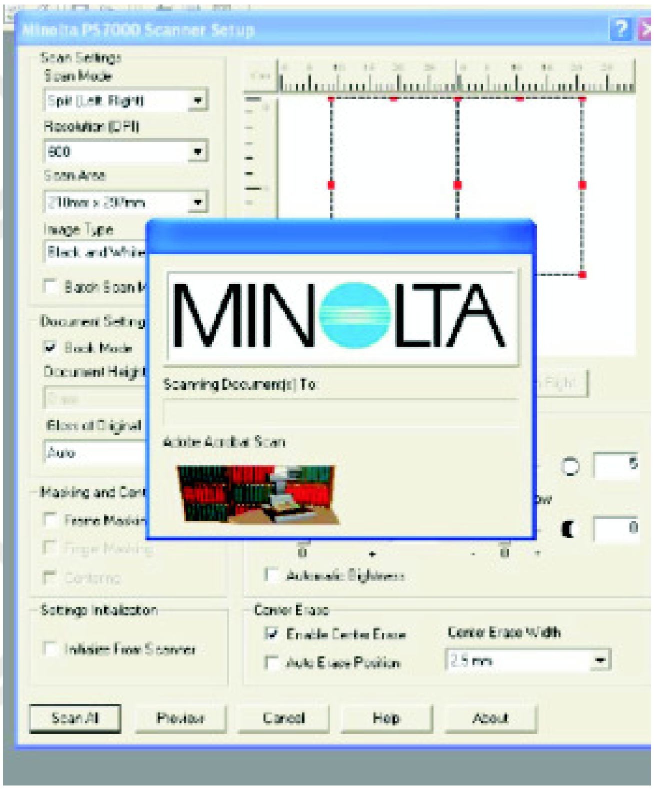
Format: Single-sided

Destination

● Open New PDF Document

○ Append To Current Document

To scan the documents click on the **Scan All** option. From the **Minolta PS7000 Scanner Setup Dialog Box that appears**.



Scan Settings

Scan Mode: Split (Left Right)

Resolution (DPI): 600

Scan Area: 210mm x 297mm

Image Type: Black and White

□ Batch Scan M

Document Setting

☑ Book Mode

Document Height

Blur of Original: Auto

Masking and Cent

□ Frame Masking

□ Finger Masking

□ Centering

Settings Initialization

□ Initialize From Scanner

Scanning Document(s) To:

Adobe Acrobat Scan

□ Automatic Brightness

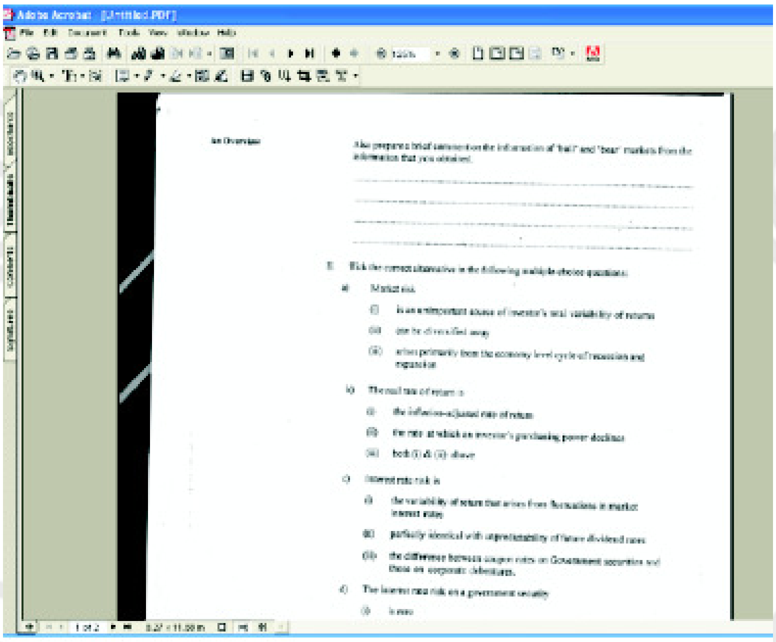
Center Erase

☑ Enable Center Erase

□ Auto Erase Position

Center Erase Width: 2.5 mm

Click on **Done** option from the **Minolta PS7000 Scanner Setup Dialog Box** which shows the file like this:


Adobe Acrobat - [Untitled.PDF]
File Edit Document Tools View Window Help
125%
Bookmarks
Thumbnails
Comments
Signatures
1 of 2
8.27 x 11.69 in

An Overview

Also prepare a brief statement on the information of 'bull' and 'bear' markets from the information that you obtained.

II Tick the correct alternative in the following multiple choice questions.

a) Market risk

(i) is an unimportant source of investor's total variability of returns

(ii) can be diversified away

(iii) arises primarily from the economy level cycle of recession and expansion

b) The real rate of return is

(i) the inflation-adjusted rate of return

(ii) the rate at which an investor's purchasing power declines

(iii) both (i) & (ii) above

c) Interest rate risk is

(i) the variability of return that arises from fluctuations in market interest rates

(ii) perfectly identical with unpredictability of future dividend rates

(iii) the difference between coupon rates on Government securities and those on corporate debentures.

d) The interest rate risk on a government security

(i) is zero

Save the file as PDF version giving .pdf extension. To change the resolution, Click on Scan Setting >> Resolution (DPI) from the Minolta PS7000 Scanner Setup Dialog Box. To change the Scan Area click on, Scan Setting >> Scan Area. You can also change the Brightness and Contrast of the scanned file by using the drag button from the right panel. If you want to change the Image Type then click on Scan Setting >> Image Type. You can also change the Brightness and Contrast of the scanned file by using the drag button from the right panel. Scanned pages can be saved as individual files or as a complete document by appending them to the current document while scanning.

6.2.2 Digitising

The process of digitisation involves capturing the physical or analogueue object through devices like scanners, digital camera, recorder etc., converting them into numerical values in bits and bytes which enables them to be read electronically.

Digitisation of text is possible either through text transcription or using optical character recognition method. Text transcription can be through keying in the text using a keyboard or by voice recognition software. Keyed in text are saved in ASCII format which do not replicate the structure and format of the original text.

OCR software converts image of text captured by a scanner into computer editable text which a word processor can read. The software tries to match the image of each letter against the pattern it recognizes making use of the stored knowledge about the shapes of individual characters. The OCR software has options for either storing the text and graphics in their original layout or converting them into ASCII or word processing format. Omnipage Pro and ABBYY Fine Reader are two commonly used OCR software.

After OCR, you can export the resulting text to a variety of word-processing, page layout, and spreadsheet applications. It also provides the option to save it directly as a PDF file.

Self Check Exercise

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

2) Name two commonly used OCR software.

....

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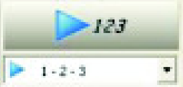
To perform OCR with automatic processing the following steps are to be followed:

1) Select all settings needed to process pages. Do this in the following:

- Get Pages drop-down list
- Layout Description drop-down list

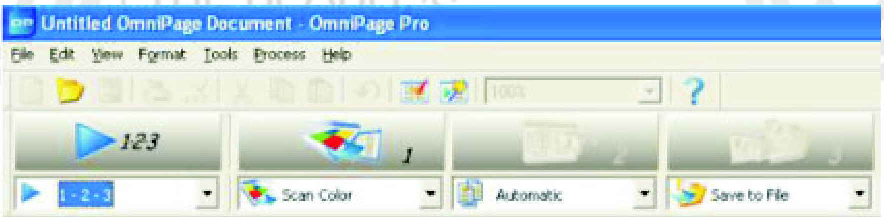
- Export Results drop-down list
- Options dialog box panels (Tools menu)

2) Click the button  or Click on the shortcut icon

Start button with 1-2-3 selected in the Workflow drop-down list. Your pages will be acquired, auto-zoned and recognized one after the other. Proofing will start if you requested it. When proofing and/or recognition are finished, an export dialog box appears. Select the destination, file type and file name to save the file.

To manually perform the OCR, follow the steps given below.

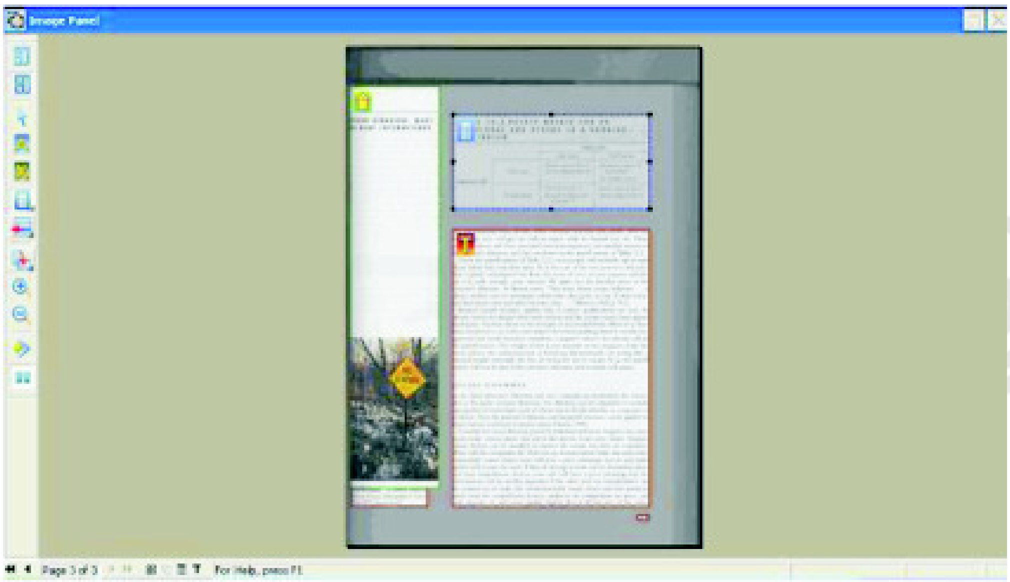
1) Scan the document as an image
    - Launch Omni Page Pro. **Start>Programs>Scansoft Omnipage Pro**
    - The Program will open with the toolbar shown below.



Untitled OmniPage Document - OmniPage Pro
File Edit View Format Tools Process Help
123
1
2
3
1-2-3
Scan Color
Automatic
Save to File

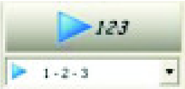
- Place the document to be scanned in the scanner.
- Click the icon above the Scan Color menu. The Program will scan the document.

2) Select for Recognition
    - Once the document opens up in Omni Page, draw a box around the text you want.
    - You can categorize the objects on the scanned image into text, table or image by selecting the appropriate option on the side toolbar.

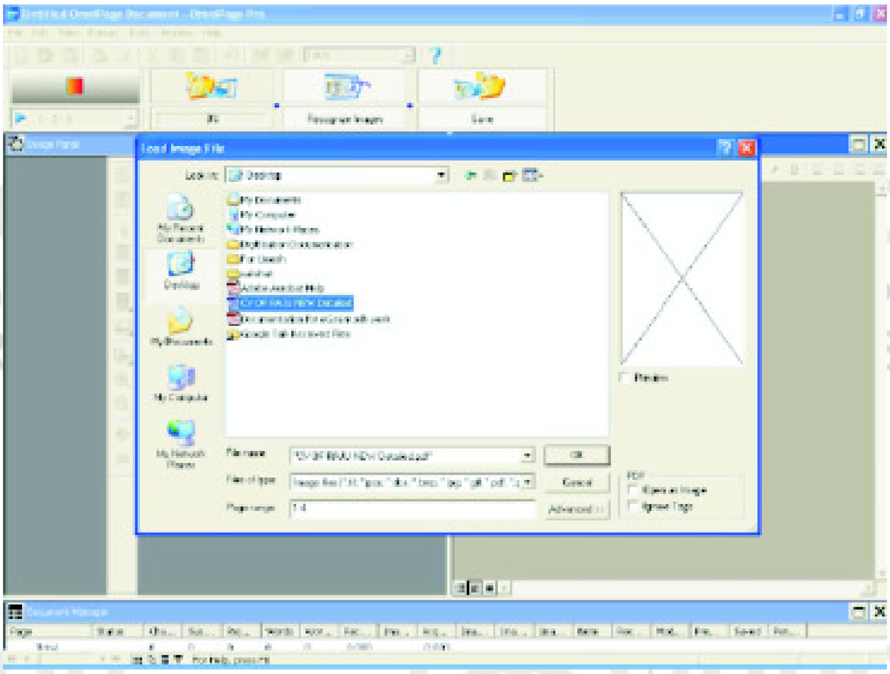


→ Image → Table → Text

You can skip this step if you want OmniPage to automatically perform the OCR and select the regions.

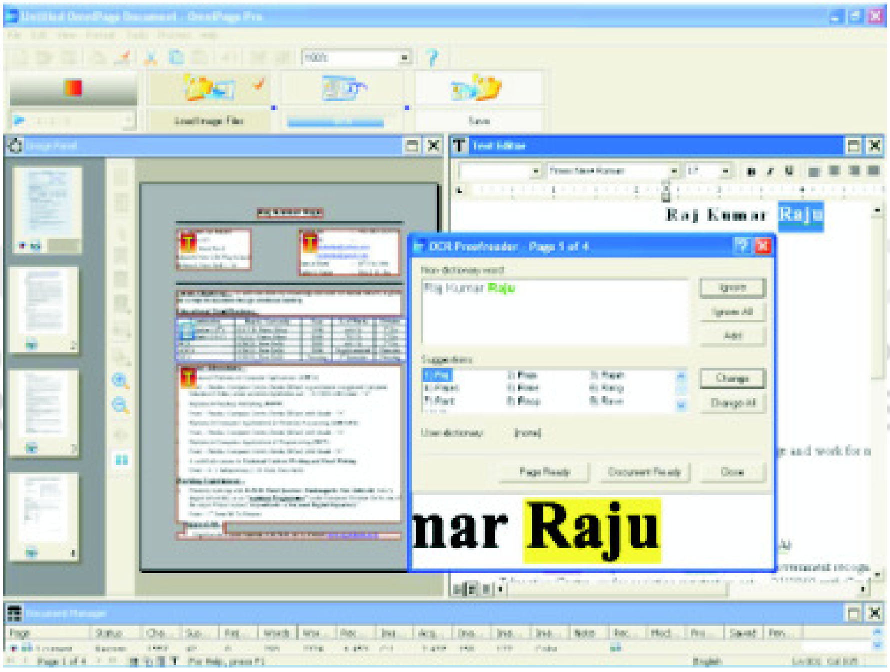
- Then choose the file to convert **OCR** by clicking on the **123 option** (**Start Button**). 

- It will give this type of screen to browse the file from any location.

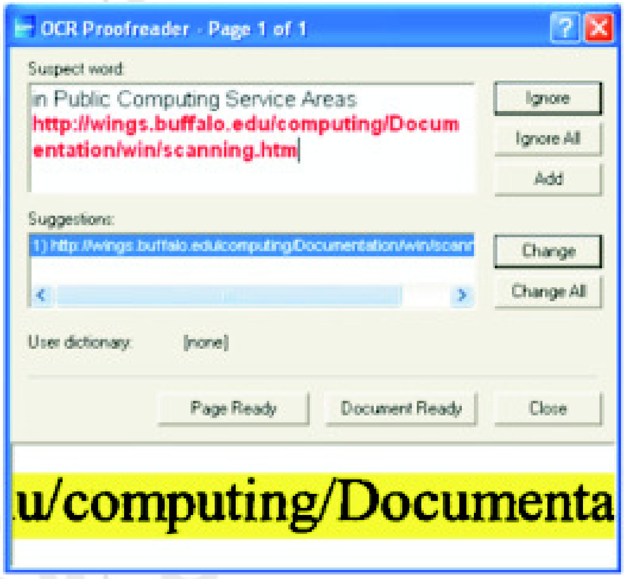


3) **Perform OCR and Proof Read**

- Select the third icon above the automatic menu. This begins the proof reading. In this step you can easily proofread recognized text by comparing it to the original image and using the built-in spellchecker as shown below.



It also gives suggestions from its built in spell checker. If **OmniPage Pro** does not recognise some words in the document, the OCR Proofreader window will appear. Choose the appropriate response to each unrecognized word.



OCR Proofreader - Page 1 of 1

Suspect word:

in Public Computing Service Areas http://wings.buffalo.edu/computing/Documentation/win/scanning.htm

Suggestions:

1) http://wings.buffalo.edu/computing/Documentation/win/scann

User dictionary: [none]

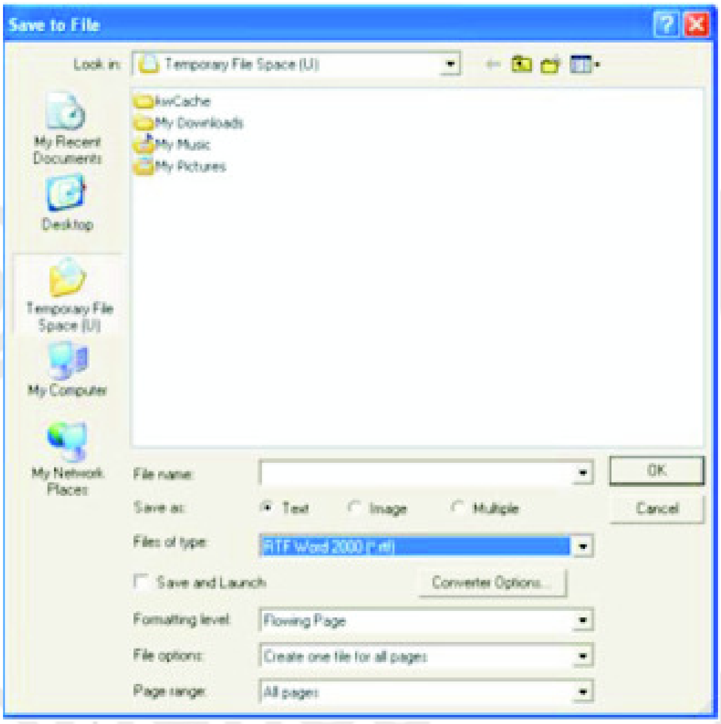
u/computing/Documenta

4) **Select page layout**

Once the proofreading is complete the document is exported to the text editor in **OmniPage**. Here you can edit the text and change the page layout.

5) **Save as a file**

- To do this click on the icon above the **Save** to **File menu**.
- Choose the location to save it at and give it a file name and select the file type to save it as. Now you can save the file in the available format you want. The typical formats available are MS-Word document *.doc, PDF *.pdf, HTML *.html, Text *.txt
- Enter your desired file name in the **File Name** text field.
- You can choose a document format from the Files of type pull-down menu. The default selection of RTF Word (*.rtf) is highly recommended, as it can be opened by most of the word processing programs.
- Click **OK** to save the file.



Save to File

Look in: Temporary File Space (U:)

kwCache
My Downloads
My Music
My Pictures

File name:

Save as: ● Text ○ Image ○ Multiple

Files of type: RTF Word 2000 (*.rtf)

□ Save and Launch

Formatting level: Flowing Page

File options: Create one file for all pages

Page range: All pages

6.3 VIDEO DIGITISATION

Analogue mediums such as vinyl, VHS cassettes, and TVs have now been replaced by superior digital medium, such as CDs, DVDs, and HDTVs. The digital medium provides higher quality content. It also allows exact reproduction from copy to copy, barring any encryption technology implemented to stop copying.

Digital video refers to video being viewed or manipulated in the digital system (for instance on a computer), or sometimes simply video stored in a digital tape format. The video may have originally been analogue source material digitised into a computer, or it may have been stored directly to a digital tape format. Traditionally, digital tape formats were only available at the professional level (D-1, Digital Betacam, etc.), but now that some digital tape formats (DV) have emerged on the consumer scene, there is even more confusion about the generic term "digital video."

DV (and related DVCAM and DVCPRO) is a digital tape format developed by a consortium of 10 companies as a "consumer" digital video format. There are now over 60 companies in the DVC consortium, including Sony, Panasonic, JVC, Philips, and other similar names you've heard before.

6.3.1 Video Capturing

In the simplest terms multimedia capturing can be stated as the process of storing or displaying the video/audio from the devices like Camcorders, Digital Cameras etc to some digital form like that of Monitor or in the binary forms (files).

As we have moved into the 21st Century, traditional analogue mediums such as vinyl, VHS cassettes, and TVs are being replaced by superior digital ones, such as CDs, DVDs, and HDTVs. Not only does digital formats allow for higher quality content, but also allows exact reproduction from copy to copy, barring any encryption technology implemented to stop copying. As computers become faster and disk storage space becomes larger, users are able to more deftly manipulate their digital data taken from analogue mediums and frequently "improve" the original analogue content using various techniques in the digital world.

System Requirements for a beginner multimedia processing system:

- x86-based PC @ 800+Mhz
- 256+MB RAM
- 40+GB of Free HD space (7200 rpm drive)
- Microsoft Windows98/ME/2000/XP
- Sound card with Line-in
- Video Capture card

These are the minimum requirements to perform reliable video capture. It is entirely possible to do video capture with less than this configuration, but good results cannot be guaranteed. Obviously, a faster CPU, more RAM, and more HD space are nothing but a good thing. Windows 9x/ME users should be aware that the FAT32 file system has a limitation preventing files from being larger than 4GB.

Windows machine is strongly recommended since the NTFS file system has no such file size limitation.

Choosing the Right Device to Capture the Video/Audio

One can purchase a video card with video-in support built right onto the card. We require the device which has a built-in "*Analogue-to-Digital Conversion with Pass-Through*" ability. This feature is quite useful since it will allow us to attach any analogue device (VCR, 8mm camcorder, etc.) to our Handy cam and then stream the digital data over FireWire to our computer.

6.3.2 Video Digitisation Process

Video digitisation is the next step used where the captured data from the analogue/ digital device like cam coder is processed and saved in various file formats understandable by Media Players (both hardware and software based).

Software for video digitisation:

1) ***VideoLAN***

VLC Player is one of the open source technologies that we are using to do the following things:

- Digitisation of content in various formats
- Re-Digitisation of multimedia video/audio content on LIVE and VOD.

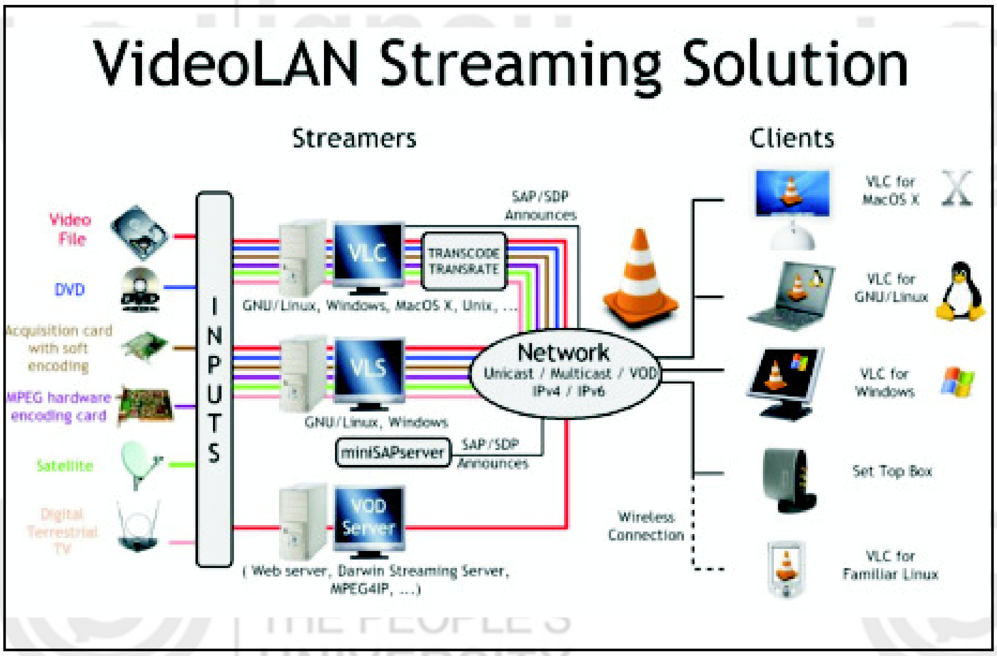
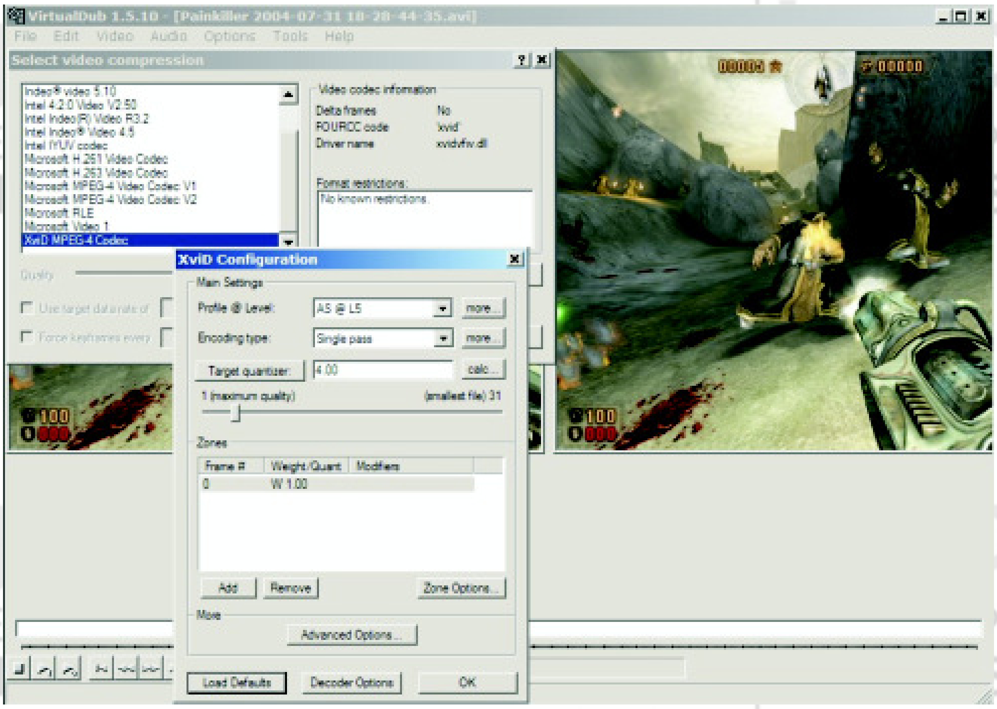


Fig. 6.2: VideoLan Streaming

2) ***Virtual DUB***

Virtual Dub is an open source video capture/processing utility for 32-bit Windows platforms, licensed under the GNU General Public License (GPL). It lacks the editing power of a general-purpose editor such as Adobe Premiere, but is streamlined for fast linear operations over video.



VirtualDub 1.5.10 - [Painkiller 2004-07-31 18-28-44-35.avi]

Select video compression

- Indeo® video 5.10
- Intel 4:2:0 Video V2.50
- Intel Indeo(R) Video R3.2
- Intel Indeo® Video 4.5
- Intel IYUV codec
- Microsoft H.261 Video Codec
- Microsoft H.263 Video Codec
- Microsoft MPEG-4 Video Codec V1
- Microsoft MPEG-4 Video Codec V2
- Microsoft RLE
- Microsoft Video 1
- XviD MPEG-4 Codec

Video codec information

Delta frames: No
FOURCC code: 'xvid'
Driver name: xvidvfw.dll

Format restrictions: No known restrictions.

XviD Configuration

Main Settings

Profile @ Level: AS @ L5
Encoding type: Single pass
Target quantizer: 4.00
1 (maximum quality) (smallest file) 31

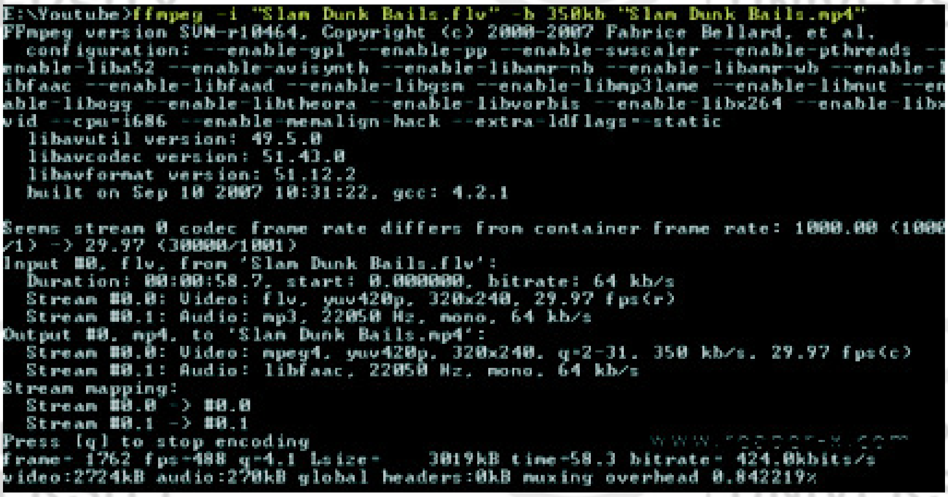
Zones

Frame #	Weight/Quant	Modifiers
0	W 1.00	

It has batch-processing capabilities for processing large numbers of files and can be extended with third-party video filters. VirtualDub is mainly geared toward processing AVI files, although it can read (not write) MPEG-1 and also handle sets of BMP images.

3) ***FFmpeg***

It is a complete Open Source, cross-platform solution to record, convert and stream audio and video. It includes **libavcodec** - the leading audio/video codec library.

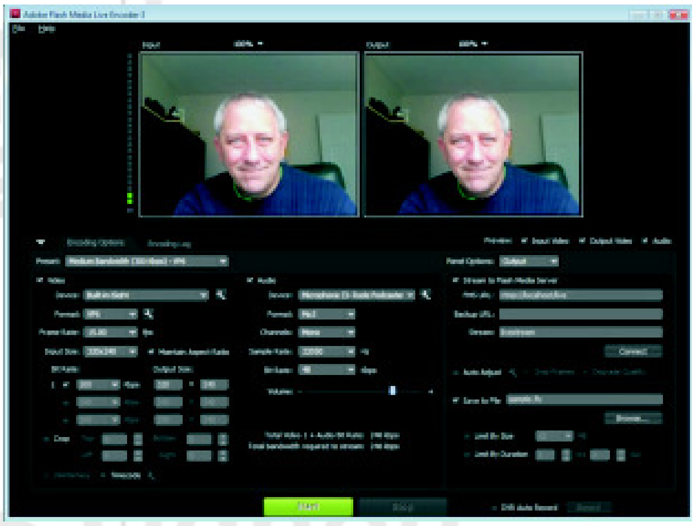


```
E:\Youtube>ffmpeg -i "Slam Dunk Bails.flv" -b 350kb "Slam Dunk Bails.mp4"
FFmpeg version SVN-r10464, Copyright (c) 2000-2007 Fabrice Bellard, et al.
  configuration: --enable-gpl --enable-pp --enable-swscaler --enable-pthreads --
enable-liba52 --enable-avisynth --enable-libamr-nb --enable-libamr-wb --enable-l
ibfaac --enable-libfaad --enable-libgsm --enable-libmp3lame --enable-libnut --en
able-libogg --enable-libtheora --enable-libvorbis --enable-libx264 --enable-libx
vid --cpu=i686 --enable-memalign-hack --extra-ldflags=-static
  libavutil version: 49.5.0
  libavcodec version: 51.43.0
  libavformat version: 51.12.2
  built on Sep 10 2007 10:31:22, gcc: 4.2.1

Seems stream 0 codec frame rate differs from container frame rate: 1000.00 (1000
/1) -> 29.97 (30000/1001)
Input #0, flv, from 'Slam Dunk Bails.flv':
  Duration: 00:00:58.7, start: 0.000000, bitrate: 64 kb/s
  Stream #0.0: Video: flv, yuv420p, 320x240, 29.97 fps(r)
  Stream #0.1: Audio: mp3, 22050 Hz, mono, 64 kb/s
Output #0, mp4, to 'Slam Dunk Bails.mp4':
  Stream #0.0: Video: mpeg4, yuv420p, 320x240, q=2-31, 350 kb/s, 29.97 fps(c)
  Stream #0.1: Audio: libfaac, 22050 Hz, mono, 64 kb/s
Stream mapping:
  Stream #0.0 -> #0.0
  Stream #0.1 -> #0.1
Press [q] to stop encoding
frame= 1762 fps=488 q=4.1 Lsize=    3019kB time=58.3 bitrate= 424.0kbits/s
video:2724kB audio:270kB global headers:0kB muxing overhead 0.842219%
```

4) ***Adobe Flash Media Encoder***

Adobe® Flash® Media Live Encoder 3 software is designed to enable us to capture live audio and video while streaming it in real time to RED 5 (Open Source) or Flash Media Server software or Flash Video Streaming Service (FVSS).



When high-quality streaming along with a very low bandwidth is our priority, Flash Media Live Encoder 3 can help you broadcast live events and around-the-clock broadcasting such as:

- Sporting events
- Concerts
- Webcasts
- News
- Educational events

6.4 AUDIO DIGITISATION

Analogue audio tapes are available in two formats: open reels and cassettes. They are available in various playing speeds and recoding formats such as mono aural, stereophonic, and quadraphonic with tracking configurations like 2 track or 4 track. To digitise analogue audio data a player needs to be attached with a computer system through audio capture card. This process of analogue to digital conversion of audio data is known as sampling. The process involves sampling the original sound many times per second. The frequency of this sample is measured in Hertz (Hz) and the range of each sample is measured in bits. When digitising sound, the frequency range in kHz determines the sampling rate and the dynamic range i.e., the ratio between lowest and highest sound determines the number of bits per sample.

Various open source products are used for the audio digitisation. Here we are basically using Open Source and Free encoders.

6.4.1 Audio Capturing

Audio can be captured using microphone. For better quality audio capture and storage of audio data via USB and Portable modes one can use voice recorders like shown in the figure below:

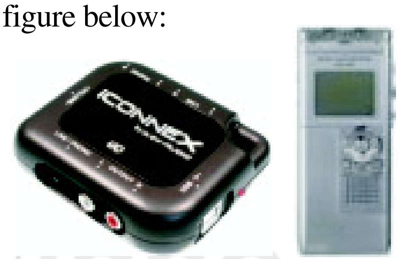
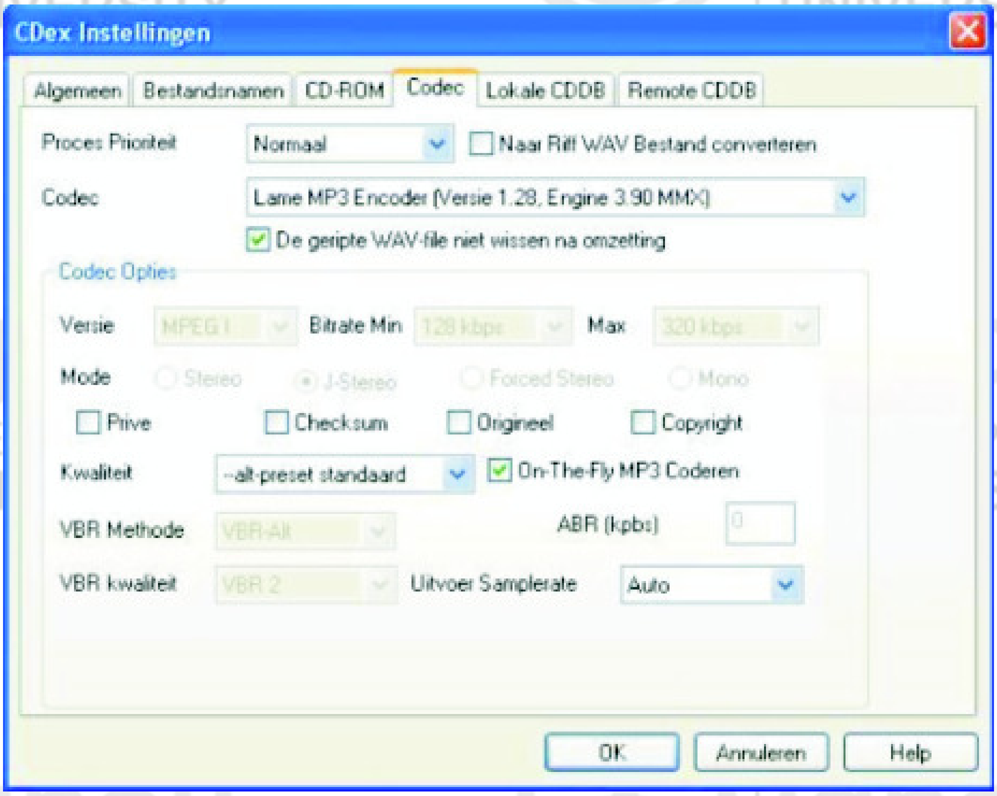


Fig. 6.17: Audio Capturing Devices

LAME Audio Encoder

LAME is a high quality MPEG Audio Layer III (MP3) encoder licensed under the LGPL. Currently LAME is considered the best MP3 encoder at mid-high bitrates and at VBR



Proces Prioriteit: Normaal

☐ Naar Riff WAV Bestand converteren

Codec: Lame MP3 Encoder (Versie 1.28, Engine 3.90 MMX)

☑ De geripte WAV-file niet wissen na omzetting

Versie: MPEG I   Bitrate Min: 128 kbps   Max: 320 kbps

Mode: ○ Stereo ● J-Stereo ○ Forced Stereo ○ Mono

☐ Prive ☐ Checksum ☐ Origineel ☐ Copyright

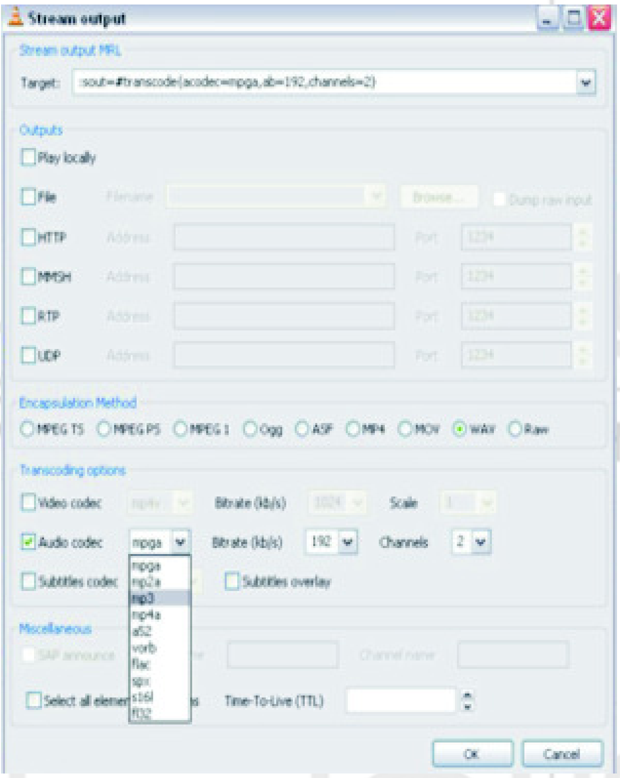
Kwaliteit: --alt-preset standaard   ☑ On-The-Fly MP3 Coderen

VBR Methode: VBR-Alt   ABR (kpbs): 0

VBR kwaliteit: VBR 2   Uitvoer Samplerate: Auto

VLC Media Player

As already seen in the Video Processing the VideoLAN can be also used for the audio processing as well.



Target: :sout=#transcode{acodec=mpga,ab=192,channels=2}

☐ Play locally

☐ File   Filename   Browse...   ☐ Dump raw input

☐ HTTP   Address   Port 1234

☐ MMSH   Address   Port 1234

☐ RTP   Address   Port 1234

☐ UDP   Address   Port 1234

○ MPEG TS ○ MPEG PS ○ MPEG 1 ○ Ogg ○ ASF ○ MP4 ○ MOV ● WAV ○ Raw

☐ Video codec   mp4v   Bitrate (kb/s) 1024   Scale 1

☑ Audio codec   mpga   Bitrate (kb/s) 192   Channels 2

mpga
mp2a
mp3
mp4a
a52
vorb
flac
spx
s16l
fl32

☐ Subtitles codec   ☐ Subtitles overlay

☐ SAP announce   Channel name

☐ Select all elements   Time-To-Live (TTL)

Self Check Exercise

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

3) What is LAME encoder?

....

....

....

....

....

6.5 AUDIO/VIDEO COMPRESSION

Audio compression algorithms are implemented in computer software as audio codec. A codec is a device or program capable of performing encoding and decoding on a digital data stream or signal. Generic data compression algorithms perform poorly with audio data, seldom reducing file sizes much below 87% of the original, and are not designed for use in real time. Consequently, specific audio "lossless" and "lossy" algorithms have been created. Lossy algorithms provide far greater compression ratios and are used in mainstream consumer audio devices. In addition to the direct applications (mp3 players or computers), digitally compressed audio streams are used in most video DVDs; digital television; streaming media on the internet; satellite and cable radio; and increasingly in terrestrial radio broadcasts.

There are five **MPEG** standards designed with a specific application and bit rate in mind for video compression. They include:

MPEG-1: for Video CD designed for up to 1.5 Mbit/sec application transmitted as .mpg files.

MPEG-2 for the compression and transmission of digital broadcast television between 1.5 and 15 Mbit/sec rate of transmission. Digital Television set top boxes and DVD compression is based on this standard.

MPEG-4 for multimedia and Web compression based on object-based compression technique.

MPEG-7 also called the Multimedia Content Description Interface provides a framework for multimedia content that will include information on content manipulation, filtering and personalization, as well as the integrity and security of the content.

MPEG-21 also called the Multimedia Framework attempts to describe the elements needed to build an infrastructure for the delivery and consumption of multimedia content, and how they will relate to each other. The work on this standard is still on.

Other video compressions are:

DV is a high-resolution digital video format used with video cameras and camcorders. DV images are compressed with a similar but superior technique to motion-JPEG, allowing for higher-quality 5:1 compression. DV video information is a constant data-rate of about 36 Mbps. The resulting video stream is transferred from the recording device via FireWire (IEEE 1394). IEEE-1394 ("FireWire") is a communications protocol for high-speed, short-distance data transfer.

H.261 is an ITU standard designed for two-way communication over ISDN lines (video conferencing) and supports data rates which are multiples of 64Kbit/s.

H.263 is based on H.261 with enhancements that improve video quality over modems.

DivX is a software application that uses the MPEG-4 standard to compress digital video, so it can be downloaded over a DSL/cable modem connection in a relatively short time with no reduced visual quality.

6.6 AUDIO/VIDEO STREAMING

With the advent of high end streaming media technology, the concept of doing live/on-demand webcast has gained popularity like never before. Webcasting allows us to extend the reach of audio/video programmes to all corners of the world, with no limitations of physical or geographical boundaries.

Web casting can be either live or on demand. The modalities of these two types of delivery are explained below:

- **Live Webcast**: The transmission of live or pre-recorded audio or video to personal computers that are connected to the Internet. A user who clicks a link to a live clip joins the **live event** in progress. Because the event is happening in real time, fast-forward, rewind, and pause capabilities are not available. Live Web casts are most suitable for high demand live presentations to large geographically dispersed audiences. Participants can attend these virtual presentations from their desktop by visiting a web site. Interaction between instructor and learners occurs in real-time. Participants can use a chat window to type in questions to the presenter during the session. Web casts simulate the look and feel of a live event and can even be recorded for later viewing for those who missed the original web cast. This method is also less expensive than satellite broadcasting.
- **On-Demand Webcast**: Pre-recorded clips are delivered, or streamed, to users upon request. A user who clicks a link to an on-demand clip watches the clip from the beginning. The user can fast-forward, rewind, or pause the clip. Therefore on demand streams can be created from archived live events or recorded clips.

6.7 FILE FORMATS AND CONTENT CREATION

As large amount of document are being digitised and made available online through digital libraries throughout the world, it is pertinent that while archiving documents, physical survival, interpretability, and usability of the data is given importance. For this it is important to give due consideration to encoding standards, file formats and also ensure that the formats are usable and accessible in future. An ideal format for the purpose of archiving would be the one that is a representation rather than a presentation. The most common formats for text archiving are native formats (mostly MS Word), pdf, pdf-a, tex/latex, and xml applications. Other formats that are also prevalent are html, sgml, xhtml. Document formats may be broadly grouped into three types: text based formats, image formats, audio and video formats.

Table 6.1: Standard Digital Formats

Category	Type	Formats	Description
Text formats	Plain text	Text Files (*.txt)	ASCII text files viewed with an editor (such as Edit or Notepad) or with a Word Processor (such as MS Word). Do not contain any kind of formatting on the document (such as bold, italics, font colour, images, etc.).
	Formatted text	1. doc or odf	Document files created, viewed and edited using programs such as MS Word or OpenOffice Writer. Formatting features such as bold, italics, justification, adding bullets and numbering, etc., is possible in such formats.
		2. pdf files	Portable Document Format (pdf) was developed by Adobe Systems to transfer formatted documents over the net so that they gave a 'printed document' look and feel. This file typerequires Adobe Acrobat Reader which is freely downloadable from the net.
Image formats Audio/ video formats-Audio-Video		• Tagged Image File Format (TIFF)	• standard for describing and storing raster image data from scanners, faxes and digital photography applications. It is capable of describing bilevel, grayscale, palette-colour, and full-colour images in several colour spaces. TIFF is extensible, portable and does not favour a particular computer operating system, compiler or processor.
		• Graphics Interchange Format (GIF)	• free and open specification for the storage of raster imagery and to facilitate the exchange of digital imagery between different computer platforms and operating systems
		• Joint Photo-graphic Experts Group (JPEG)	• JPEG is a standardized lossy image compression mechanism that is designed for compressing full-colour and grayscale images.
		• Audio Video Interleave (AVI)	• **for storing and playing audio and video data on a PC. The format is limited to a 320 x 240 video resolution and playback rate of 30 fps.**
		• MPEG-4	• MPEG-4 is built on the MPEG-1, MPEG-2 and Quicktime MOV standards. These files are designed for transmission over a narrow Internet bandwidth,
		• Quicktime (MOV)	• The MOV file format was developed by Apple Computer to create, play and stream high-quality audio and video files on both Macintosh and Windows computers using the Quicktime software application
		• Real Networks' RealVideo (RM)	• RealVideo was the first streaming video format available on the World Wide Web. A RealVideo clip consists of two parts, a visual track that is encoded with RealVideo codecs (COmpression/ DECompression) and an audio track encoded using RealAudio codecs

Table 6.2: Common Formats

Format	File Extension	Notes
XML	.xml	An XML file, validated with DTD or schema specified, is a format suitable for preservation.
SGML	.sgml.sgm	A SGML file, validated, with DTD specified, is suitable for preservation.
HTML	.htm, .html	Hypertext markup language file, which may in principle be validated against a DTD. In practice invalid documents are often produced and used.
XHTML	.xhtml, .htm, .html	XML-conformant HTML file, is required to be well-formed and valid.
DTD	.dtd	Document Type Definition. Defines the rules and syntax applied to a document. To be supplied with an SGML or XML document.
XML Schema	.xsd	An XML schema file. Defines the rules and syntax applied to a document. To be supplied with an XML document.
Pseudo-SGML	.sgm, .sgml. .txt or other	A text file employing some SGML-like formalisms for inserting markup, but not valid SGML. Suitability depends on whether tagging is consistently applied and well-documented, sufficient for later migration.
Various non-SGML encodings in text files	.txt or other	Suitability depends on acceptance as de facto standard in an academic community, plus an assessment of its likely future viability and level of documentation

6.8 SUMMARY

The conversion of analogue sources into digital form and their appropriate storage and processing form an important part of building a digital library. Digitisation is a complex process requiring managerial and technical skills. Proper planning and management help in keeping the cost down, and they also lead to the successful completion of a digitisation project. Digitisation can be carried out in-house or outsourced.

Various technical issues need to be considered in a digitisation project ranging from hardware to software and standards for file formats, file compression and post-processing. Selection of metadata format depends on the nature of the documents as well as the nature and needs of the users.

6.9 ANSWERS TO SELF CHECK EXERCISES

1) For converting hard copies into machine readable form three options available are:

   1) Keying in the text

   2) Scanning and capturing them as image files

   3) OCR the files

2) Omnipage Pro and ABBYY Fine Reader are two commonly used OCR software.

3) LAME is a high quality MPEG Audio Layer III (MP3) encoder licensed under the LGPL. Currently LAME is considered the best MP3 encoder at mid-high bitrates and at VBR.

6.10 KEYWORDS

Charge-coupled device (CCD) : A device for the movement of electrical charge, usually from within the device to an area where the charge can be manipulated, for example conversion into a digital value.

Contact Image Sensors (CIS) : Relatively recent technological innovation in the field of optical flatbed scanners that are rapidly replacing CCDs in low power and portable applications.

Photomultiplier Tubes (PMT) : Members of the class of vacuum tubes, and more specifically vacuum phototubes, are extremely sensitive detectors of light in the ultraviolet, visible, and near-infrared ranges of the electromagnetic spectrum.

6.11 REFERENCES AND FURTHER READING

http://www.librarydigitisation.com/

http://www.records.nsw.gov.au/recordkeeping/advice/designing-implementing-and-managing-systems/digitisation-of-analogue-audio-and-video

http://www.jiscdigitalmedia.ac.uk/digitisation

http://www.tape-online.net/Short_Guidelines_Video_Digitisation.pdf

http://travesia.mcu.es/portalnb/jspui/bitstream/10421/6742/1/digitisation.pdf

http://www.slq.qld.gov.au/about-us/projects-and-partnerships/distributed-collection-of-queensland-memory/digitisation-toolkit/what-is-digitisation

UNIT 7 CREATING DIGITAL LIBRARIES USING DSPACE

Structure

7.0 OBJECTIVES

After going through this Unit, you will be able to:

- Describe the functional features of DSpace;
- Install Windows version of Dspace; and
- Create digital library using DSpace.

7.1 INTRODUCTION

DSpace is open source software, a turnkey repository application used by more than 1000+ organisations and institutions worldwide to provide durable access to digital resources. In India more than 140 institutions are using DSpace for building digital repositories.

DSpace is a software platform that enables organisations to:

- capture and describe digital material using a submission workflow module, or a variety of programmatic ingest options.
- distribute an organisation's digital assets over the web through a search and retrieval system.
- preserve digital assets over the long term.

The DSpace project was initiated in July 2000 as part of the HP-MIT alliance. The project was given $1.8 million USD by HP over two years to build a digital archive for MIT that would handle the 10,000 articles produced by MIT authors annually. DSpace has gone through several versions and the current stable release available is version 4.2.

The DSpace Foundation was formed in 2007 as a non-profit organisation to provide support to the growing community of institutions that use DSpace. The foundation's mission is to lead the collaborative development of open source software to enable permanent access to digital works.

The code for DSpace is kept within a source code control system (http://dspace.svn.sourceforge.net/viewvc/dspace/) that allows code to be added or modified over time, whilst maintaining a track of all changes and a note of why the change was made and who made it. The Control of the source code repository is delegated to a small group of 'committers' who have the ability to change the code and release new versions. The committers work with the wider community of DSpace users to fix bugs and improve the software with new features.

In this we will guide you through the process of installation of DSpace (on a window platform) and familiarise you with the process of using and building collection in Dspace.

The Unit has been adapted from the DSpace official documentation and the Courseware developed by Aberystwyth University. Both the documents are available under the terms of either the GNU General Public License (http://www.gnu.org/licenses/gpl.html) and the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0/), for distribution and modification. The documents used are listed in the References and Further Readings section for further reference and you may refer them for further details.

7.2 FUNCTIONAL FEATURES OF DSPACE

The digital content in DSpace is presented in an organised tree structure of Community and Collections. Individual items can be accessed ether through browsing the tree structure or searching with the Java freeware search engine Lucene built within. Each item gets a metadata description together with files available for download.

Full-text search : DSpace can process uploaded text based contents for full-text searching. Users may search for specific keywords that only appear in the actual content and not in the provided description.

Navigation : Users in DSpace find their way to relevant content through:

- **Searching** for one or more keywords in metadata or extracted full-text
- **Faceted browsing** through any field provided in the item description.
- Through **external reference**, such as a Handle
- **Browse** is another important mechanism for discovery in DSpace, whereby the user views a particular index, such as the title index, and navigates around it in search of interesting items.

Supported file types : While DSpace is most known for hosting text based materials including scholarly communication and electronic theses and dissertations (ETDs), it can accommodate any type of uploaded file. Files uploaded on DSpace are referred to as "Bitstreams" as after ingestion, files in DSpace are stored on the file system as a stream of bits without the file extension.

Optimized for Google Indexing : For the Google Scholar indexing, DSpace has added specific metadata in the page head tags that facilitates indexing in Scholar. Popular DSpace repositories often generate over 60% of their visits from Google pages.

OpenURL Support

DSpace supports the OpenURL protocol through linking server software called SFX server. DSpace will display an OpenURL link on every item page, automatically using the Dublin Core metadata if SFX server is implemented.

Self Check Exercise

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

1) Enumerate functional features of DSpace.

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Metadata Management

DSpace holds three types of metadata about archived content:

- **Descriptive Metadata**: A qualified Dublin Core metadata schema loosely based on the Library Application Profile set of elements and qualifiers is provided by default. However, one can configure multiple schemas and select metadata fields from a mix of configured schemas to describe items.
- **Administrative Metadata**: This includes preservation metadata, provenance and authorization policy data.
- **Structural Metadata**: This includes information about how to present an item, or bitstreams within an item, to an end-user, and the relationships between constituent parts of the item.

Choice Management and Authority Control

This is a configurable framework that lets you define plug-in classes to control the choice of values for a given DSpace metadata fields. It also lets you configure fields to include "authority" values along with the textual metadata value. The choice-control system includes a user interface in both the Configurable Submission UI and the Admin UI (edit Item pages) that assists the user in choosing metadata value.

Licensing

DSpace offers support for licenses on different levels:

- Collection and Community Licenses
- License granted by the submitter to the repository
- Creative Commons Support for DSpace Items

Persistent URLs and Identifiers

Researchers require a stable point of reference for their works. To help solve this problem, a core DSpace feature is the creation of a persistent identifier for every item, collection and community stored in DSpace. To persist identifiers, DSpace requires a storage- and location- independent mechanism for creating and maintaining identifiers. DSpace uses the CNRI Handle System for creating these identifiers.

Similar to handles for DSpace items, bitstreams also have 'Persistent' identifiers. They are more volatile than Handles, since if the content is moved to a different server or organisation, they will no longer work (hence the quotes around 'persistent'). However, they are more easily persisted than the simple URLs based on database primary key previously used. This means that external systems can more reliably refer to specific bitstreams stored in a DSpace instance.

Getting content into DSpace

Rather than being a single subsystem, ingesting is a process that spans several. Below is a simple illustration of the current ingesting process in DSpace.

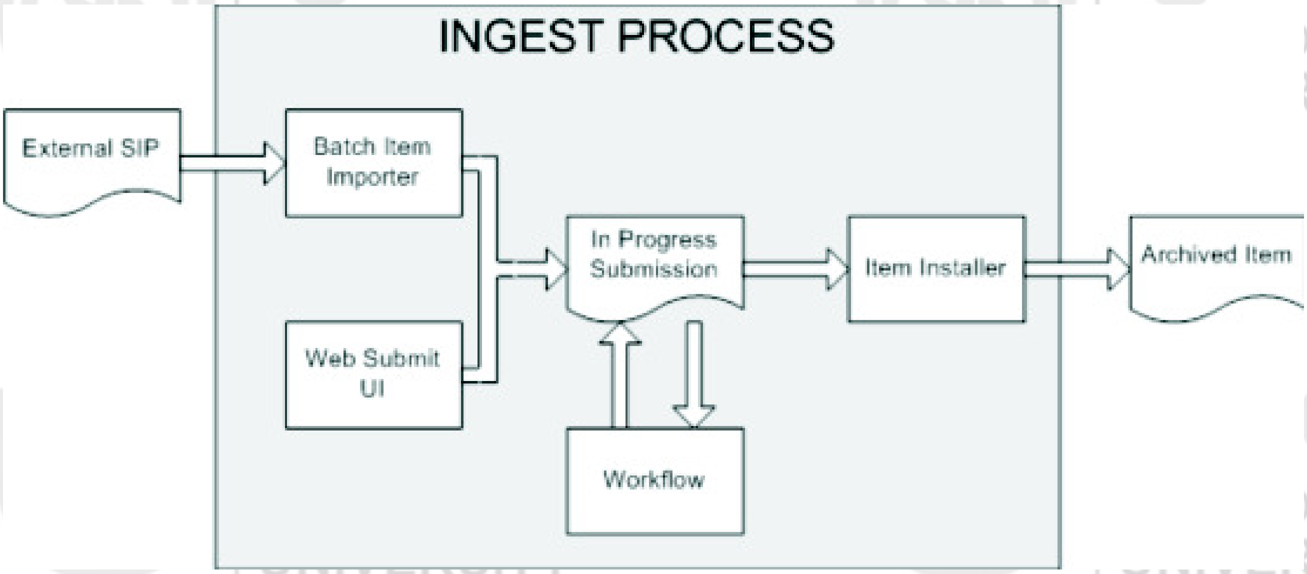


Fig. 7.1: DSpace Ingest Process

(**Source:** https://wiki.duraspace.org/display/DSDOC4x/Functional+Overview)

The batch item importer is an application, which turns an external SIP (an XML metadata document with some content files) into an "in progress submission" object. The Web submission UI is similarly used by an end-user to assemble an "in progress submission" object.

When the Batch Ingester or Web Submit UI completes the In Progress Submission object, and invokes the next stage of ingest (be that workflow or item installation), a provenance message is added to the Dublin Core which includes the filenames and checksums of the content of the submission. Likewise, each time a workflow changes state (e.g. a reviewer accepts the submission), a similar provenance statement is added. This allows us to track how the item has changed since a user submitted it.

Once any workflow process is successfully and positively completed, the In Progress Submission object is consumed by an "item installer", that converts the In Progress Submission into a fully blown archived item in DSpace. The item installer:

- Assigns an accession date
- Adds a "date.available" value to the Dublin Core metadata record of the item

- Adds an issue date if none already present
- Adds a provenance message (including bitstream checksums)
- Assigns a Handle persistent identifier
- Adds the item to the target collection, and adds appropriate authorization policies
- Adds the new item to the search and browse index.

Workflow Steps

A collection's workflow can have up to three steps. Each collection may have an associated e-person group for performing each step; if no group is associated with a certain step, that step is skipped. If a collection has no e-person groups associated with any step, submissions to that collection are installed straight into the main archive.

In other words, the sequence is this: The collection receives a submission. If the collection has a group assigned for workflow step 1, that step is invoked, and the group is notified. Otherwise, workflow step 1 is skipped. Likewise, workflow steps 2 and 3 are performed if and only if the collection has a group assigned to those steps.

When a step is invoked, the submission is put into the 'task pool' of the step's associated group. One member of that group takes the task from the pool, and it is then removed from the task pool, to avoid the situation where several people in the group may be performing the same task without realizing it.

The member of the group who has taken the task from the pool may then perform one of three actions:

Workflow Step	Possible actions
1	Can accept submission for inclusion, or reject submission.
2	Can edit metadata provided by the user with the submission, but cannot change the submitted files. Can accept submission for inclusion, or reject submission.
3	Can edit metadata provided by the user with the submission, but cannot change the submitted files. Must then commit to archive; may not reject submission.

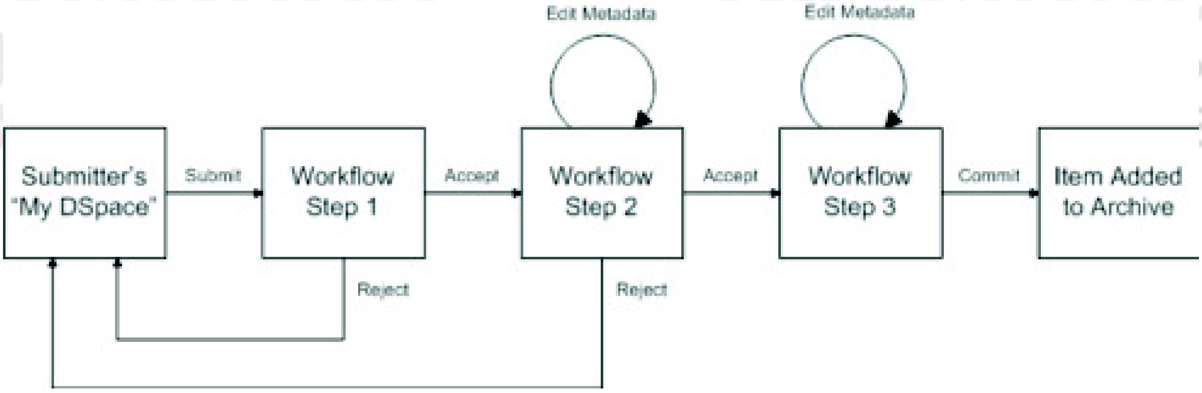


Fig. 7.2: Submission Workflow in DSpace

(**Source:** https://wiki.duraspace.org/display/DSDOC4x/Functional+Overview)

If a submission is rejected, the reason (entered by the workflow participant) is e-mailed to the submitter, and it is returned to the submitter's 'My DSpace' page. The submitter can then make any necessary modifications and re-submit, whereupon the process starts again.

If a submission is 'accepted', it is passed to the next step in the workflow. If there are no more workflow steps with associated groups, the submission is installed in the main archive.

One last possibility is that a workflow can be 'aborted' by a DSpace site administrator. This is accomplished using the administration UI.

The reason for this apparently arbitrary design is that is was the simplest case that covered the needs of the early adopter communities at MIT. The functionality of the workflow system will no doubt be extended in the future.

Command line import facilities

DSpace includes batch tools to import items in a simple directory structure, where the Dublin Core metadata is stored in an XML file. This may be used as the basis for moving content between DSpace and other systems.

Registration for externally hosted files

Registration is an alternate means of incorporating items, their metadata, and their bitstreams into DSpace by taking advantage of the bitstreams already being in accessible computer storage.

Getting content out of DSpace

- **OAI Support**

  The Open Archives Initiative has developed a protocol for metadata harvesting. This allows sites to programmatically retrieve or 'harvest' the metadata from several sources, and offer services using that metadata, such as indexing or linking services. Such a service could allow users to access information from a large number of sites from one place.

- **SWORD Support**

  SWORD (Simple Web-service Offering Repository Deposit) is a protocol that allows the remote deposit of items into repositories.

- **Command Line Export Facilities**

  DSpace includes batch tools to export items in a simple directory structure, where the Dublin Core metadata is stored in an XML file.

- **Packager Plugins**

  Packagers are software modules that translate between DSpace Item objects and a self-contained external representation, or "package". A *Package Ingester* interprets, or *ingests*, the package and creates an Item. A *Package Disseminator* writes out the contents of an Item in the package format.

Crosswalk Plugins

Crosswalks are software modules that translate between DSpace object metadata and a specific external representation. An *Ingestion Crosswalk* interprets the external format and crosswalks it to DSpace's internal data structure, while a *Dissemination Crosswalk* does the opposite.

The Packager plugins and OAH-PMH server make use of crosswalk plugins.

Supervision and Collaboration

In order to facilitate, as a primary objective, the opportunity for thesis authors to be supervised in the preparation of their e-theses, a supervision order system exists to bind groups of other users (thesis supervisors) to an item in someone's pre-submission workspace. The bound group can have system policies associated with it that allow different levels of interaction with the student's item; a small set of default policy groups are provided:

- Full editorial control
- View item contents
- No policies

User Management

E-People and Groups are the way DSpace identifies application users for the purpose of granting privileges. Both E-People and Groups are granted privileges by the authorization system described below.

- **User Accounts (E-Person)**

DSpace holds the following information about each e-person:

- E-mail address.
- First and last names.
- Whether the user is able to log in to the system via the Web UI, and whether they must use an X509 certificate to do so.
- A password (encrypted), if appropriate.
- A list of collections for which the e-person wishes to be notified of new items.
- Whether the e-person 'self-registered' with the system; that is, whether the system created the e-person record automatically as a result of the end-user independently registering with the system, as opposed to the e-person record being generated from the institution's personnel database, for example.
- The network ID for the corresponding LDAP record, if LDAP authentication is used for this E-Person.

- **Subscriptions**

  As noted above, end-users (e-people) may 'subscribe' to collections in order to be alerted when new items appear in those collections.

- **Groups**

  Groups are another kind of entity that can be granted permissions in the authorization system. A group is usually an explicit list of E-People; anyone identified as one of those E-People also gains the privileges granted to the group.

  Administrators can also use groups as "roles" to manage the granting of privileges more efficiently.

Access Control

Authentication

Authentication is when an application session positively identifies itself as belonging to an E-Person and/or Group.

Authorization

DSpace's authorization system is based on associating actions with objects and the lists of EPeople who can perform them. The associations are called Resource Policies, and the lists of EPeople are called Groups. There are two built-in groups: 'Administrators', who can do anything in a site, and 'Anonymous', which is a list that contains all users. Assigning a policy for an action on an object to anonymous means giving everyone permission to do that action. The following actions are possible:

Usage Metrics

DSpace is equipped with SOLR based infrastructure to log and display page views and file downloads.

- **Item, Collection and Community Usage Statistics**

  Usage statistics can be retrieved from individual item, collection and community pages.

- **System Statistics**

  Various statistical reports about the contents and use of your system can be automatically generated by the system. These are generated by analyzing DSpace's log files.

Digital Preservation

- **Checksum Checker**

  The purpose of the checker is to verify that the content in a DSpace repository has not become corrupted or been tampered with.

System Design

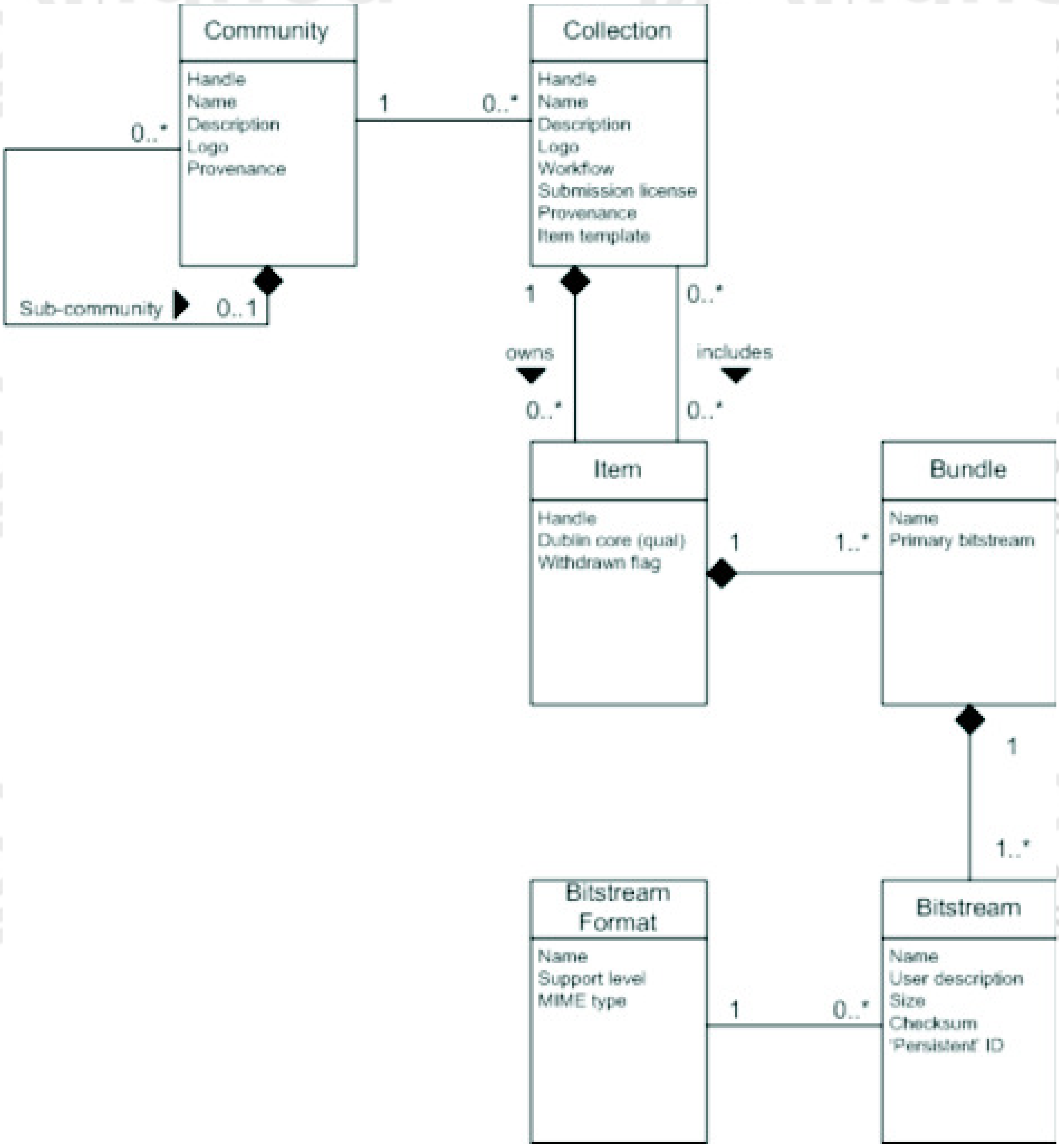


Fig. 7.3: Data Model Diagram

(Source: https://wiki.duraspace.org/display/DSDOC4x/Functional+Overview)

Each DSpace site is divided into *communities*, which can be further divided into *sub-communities* reflecting the typical university structure of college, department, research center, or laboratory.

Communities contain *collections*, which are groupings of related content. A collection may appear in more than one community.

Each collection is composed of *items*, which are the basic archival elements of the archive. Each item is owned by one collection. Additionally, an item may appear in additional collections; however every item has one and only one owning collection.

Items are further subdivided into named *bundles* of *bitstreams*. Bitstreams are, as the name suggests, streams of bits, usually ordinary computer files. Bitstreams that are somehow closely related, for example HTML files and images that compose a single HTML document, are organized into bundles.

Storage Resource Broker (SRB) Support

DSpace offers two means for storing bitstreams. The first is in the file system on the server. The second is using SRB (Storage Resource Broker). Both are achieved using a simple, lightweight API.

SRB is purely an option but may be used in lieu of the server's file system or in addition to the file system. Without going into a full description, SRB is a very robust, sophisticated storage manager that offers essentially unlimited storage and straightforward means to replicate (in simple terms, backup) the content on other local or remote storage resources.

7.3 INSTALLING DSPACE ON WINDOWS

Running DSpace on Windows is actually rather similar to running it on any other operating system. For the most part, you should be able to follow the normal DSpace Installation Documentation. However, this page provides you with some hints that are specific to Windows.

Pre-requisite Software

You'll need to install this pre-requisite software (for DSpace 1.5.x and higher). Check the "Windows Installation" section of the System Documentation for the most recent pre-requisites, as they sometimes differ based on the version of DSpace you are running.

- **Java SDK (jdk-6u14-javafx-1_2-windows-i586) :** JDK is a development environment for building applications, applets, and components using the Java programming language. Download it from http://java.sun.com/javase/downloads/widget/jdk6.jsp. For Ant to work properly, you should ensure that JAVA_HOME is set.

- **PostgreSQL (8.x for Windows) :** PostgreSQL is a powerful, open source object-relational database system. It has native programming interfaces for *C/C++,* Java, .Net, Perl, Python, Ruby, Tcl, ODBC, among others. This comes with a Windows installer app. Make sure the ODBC + JDBC options are selected, as well as the pgAdmin III tool. We will be using it for storing the database of our repository. You can download it from: http://www.postgresql.org/download/windows.

- **Apache Tomcat (apache-tomcat-5.5.28) :** An open source software implementation of the Java Servlets to serve as a Web server. You can download it from: http://tomcat.apache.org/download-60.cgi.

- **Apache Maven (2.2.1-bin) :** Apache Maven is a software project management and comprehension tool. Just unzip it wherever you want it installed, and add [path-to-apache-maven]\bin to your system PATH.

- **Apache Ant 1.7.x.** is a Java-based build tool. Just unzip it wherever you want it installed, and add [path-to-apache-ant]\bin to your system PATH.

Self Check Exercise

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

2) What are the prerequisite software required for DSpace?

....

....

....

....

....

General Installation Steps

1) Download the DSpace software from SourceForge (http://sourceforge.net/projects/dspace/) and other prerequisite software. Untar or unzip it and save it in a folder.

2) **Install JDK :** Double click and execute the installer file of Java that you have downloaded. Finish JDK installation by clicking Finish. Another installer will start automatically for installing **JRE**. Click next (or you may cancel it also)> Click finish to close the installer. Next is to set up the Environmental variables and JAVA HOME.

   Right click on **My computer**> go to **Properties**> go to **Advanced TAB >** click on Environmental variables> select **PATH** in **system variables** section> click EDIT button. Open your program files directories in C drive and locate JAVA in Programme Files Directory> JAVA\JDK x.x.x.x\ bin (C:\Program Files\Java\jdk1.6.0_14\bin) folder. Copy the file path from the address bar of windows explorer. > Paste this path in system variable window (opened earlier) but use as a separator 'semicolon' (;) before it > Click ok. In **User Variable** segment> Click on NEW to set up a new user variable of **JAVA_HOME**. Variable name will : JAVA HOME and Variable Value: C:\Program Files\Java\jdk1.6.0_14 or according to your installed version. Give the path of your java home directory located in program files. Click ok, and apply the settings.

3) **Install Apache Maven and Apache Ant :** Extract the files of **Apache Maven and Apache Ant** into C drive. Then give path for apache maven in system variables: Right click my computer> properties>Advanced> Environmental variables > Click on path and edit it > Add path "C:\apache-maven-2.2.1 \bin" Now define path variable for apache ant in the same way Open the extracted folder of apache ant in C drive, copy the folder path from windows explorer address bar and paste it in system path. Click ok. This will complete the task of defining all system paths **[C:\Program Files\Java\jdkl.6.0 _14\bin; C:\apache-maven-2.2.1 \bin; C:\apache-ant-I.8.0\bin].** Now define ANT HOME **in user variables. Variable name: ANT HOME Variable value: C:\apache-ant-1.8.0 >** Click ok and apply the settings. All system paths and user variables are defined. We can also check, what we have done till now. Open command prompt and run the following command to see the java version C:/> 'java –version' Same way

you can check ‘ant –version’ and ‘mvn –version’ and the command prompt will show relevant information regarding the respective software. If it appears all right then we may conclude that all packages java, maven and ant are successfully installed and paths are appropriately defined.

4) **Install Apache Tomcat :** Double click on Apache tomcat installer file and > Now, tick mark all the components in order to **do full installation** and then click next. > In this window give your **usemame and password**, that will give you access to monitor and control you tomcat server web interface. Then click next. > **Make sure that your java virtual machine path is appropriate with your JRE installation folder**. Click install. > Click finish… this will start tomcat service automatically. You will see Apache icon in Notification area of Taskbar.

5) **Install PostgreSQL :** Before installing PostgreSql check the file system of your local disc. It needs be NTFS. To identify this, right click the local disc > select “Properties”, see the “File system”. If all the drives in your system are FAT, then convert a convenient disc to NTFS. For converting, go to command prompt and type C:\>CONVERT C: /fs:ntfs this command will convert your c drive into NTFS file system. If you already have C drive with NTFS file system partition, you may simply proceed to install PostgreSQL by double clicking the installer file of postgreSQL. You must provide the database password to administrate your DATABASE. Click next. > Check DATABASE port number. **The port number should be 5432**. After installation of Postgres SQL is over, the next task is to create database and login rolls. For this open pgAdminIII. Connect to the database (provide password). Database will start … and then create login roll. > Right click on Login roles icon and click New Login Role. > Fill up the fields of role **name with dspace** and your **password is also dspace**. Then open role privileges tab. > Tick mark on icons named: Can create database objects, and can create roles. And then click ok. Login role is created. Now create Database. Right click on Database icon and click New Database. Fill up **Database name: dspace** and select **database owner dspace**. Click ok. Dspace database is created.

6) **Install DSpace :** Ensure the PostgreSQL service is running, and then run pgAdmin III (Start -> PostgreSQL 8.x -> pgAdmin III). Create the directory for the DSpace installation (e.g. C:\DSpace).

Build DSpace in the normal fashion. From [dspace-source]\dspace run:

```
mvn package
```

Then install DSpace to your specified location. From [dspace-source]\dspace\target\dspace-[version].dir run:

```
ant fresh_install
```

Create an administrator account, e.g. assuming C:\dspace is where your DSpace installation is:

```
C:\dspace\bin\dsrun org.dspace.administer.CreateAdministrator
```

(then enter the required info)

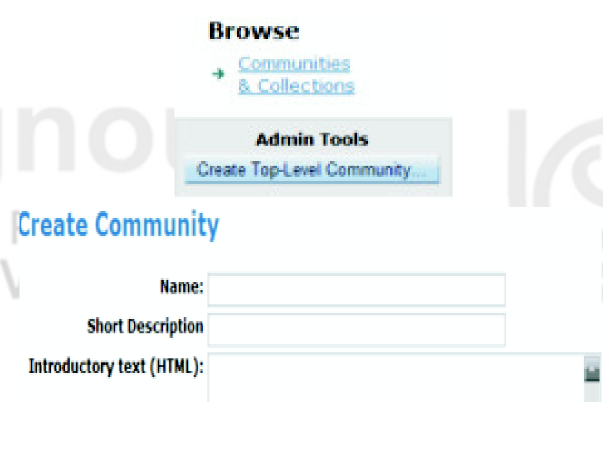
Copy the .war Web application files from C:\dspace\webapps to Tomcat's webapps dir, which should be somewhere like C:\Program Files\Apache Software Foundation\Tomcat\webapps

Start the Tomcat service

Browse http://localhost:8080/dspace. You should see the DSpace home page!

7.4 WORKING WITH DSPACE

1) Creating Communities



Name:

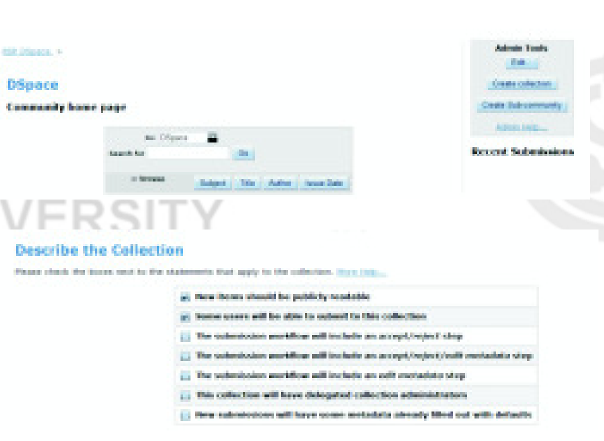
Short Description

Introductory text (HTML):

Sign in as an administrator

- Select 'Community & Collection' from the browse menu
- Select 'Create Top-Level Community' from the Admin Tools menu
- Compete the descriptive metadata for the Community
- Click 'Create' to complete the Community

2) Creating Collection



Please check the boxes next to the statements that apply to the collection. More Help...

☑ New items should be publicly readable

☑ Some users will be able to submit to this collection

□ The submission workflow will include an accept/reject step

□ The submission workflow will include an accept/reject/edit metadata step

□ The submission workflow will include an edit metadata step

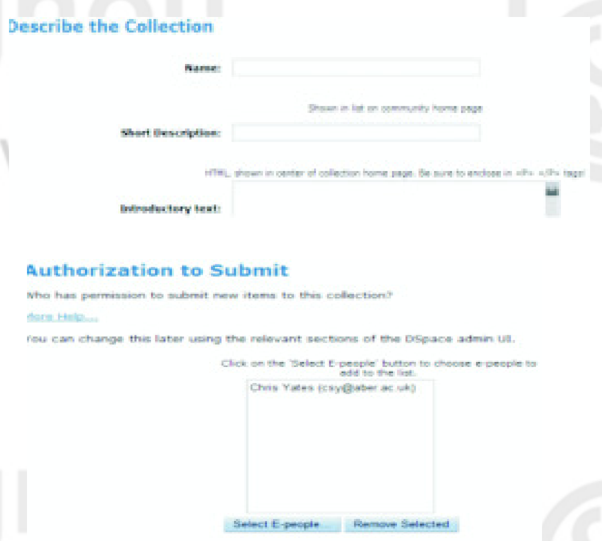
□ This collection will have delegated collection administrators

□ New submissions will have some metadata already filled out with defaults

Navigate to the parent Community of the collection to be created

- Select 'Create Collection' from the Admin Tools menu
- Select the appropriate statements that apply to this collection

3) Descriptive Metadata for the Collection



Name:

Shown in list on community home page

Short Description:

HTML, shown in center of collection home page. Be sure to enclose in <P> </P> tags!

Introductory text:

Who has permission to submit new items to this collection?

You can change this later using the relevant sections of the DSpace admin UI.

Click on the 'Select E-people' button to choose e-people to add to the list.

Chris Yates (csy@aber.ac.uk)

- Provide Descriptive Metadata for the collection
- Select the users who can submit to the Collection and the 'Next'
- Click 'Update' to complete the collection creation process

4) Creating a user and groups

Users require accounts to be able to log in and submit or edit items. Logical collections of users can be placed in groups to make administration easier.

DSpace has the facility User Self creation of account for which the following steps are to be followed:

- Click on My DSpace link
- Click on 'New user? Click here to register.'
- Enter an email address and press 'Register'
- Follow the link in the email that is sent for verification
- Provide name, telephone number, and a password
- New users have no privileges.

Users may be combined into logical groups for managing users and assigning privileges. Two special groups are possible on DSpace: i) Anonymous group in which there are no users in this group. Anyone can view the content without being logged, ii) Administrator group contains users who have full administrator access.

Administrator needs to be created directly on the DSpace server ([dspace]/ bin/create-administrator) with the email address, first name, last name, and password details.

5) Metadata in DSpace

DSpace uses Dublin Core by default. Dublin core is made up of elements, and qualifiers. There are 15 base elements:

Title	Format
Creator	Identifier
Subject	Source
Description	Language
Publisher	Relation
Contributor	Coverage
Date	Rights
Type	

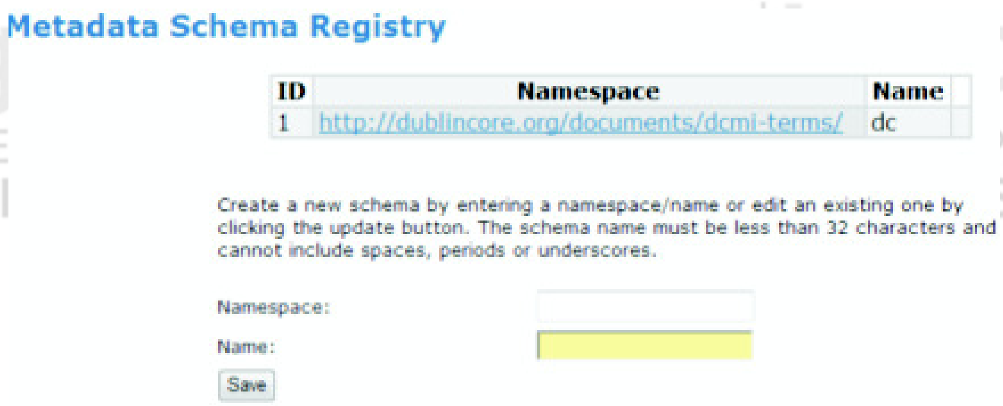
The elements can be further refined through the use of qualifiers as shown below in the case of the base DC element Title:

Schema = 'dc'

Elements viz. Title / Creator / Subject / Description

Qualifiers e.g. Title.main / Title.subtitle / Title.series.

Multiple schemas can be held in the metadata registry of DSpace and the access for which is through Administer menu -> Metadata Registry.



Metadata Schema Registry

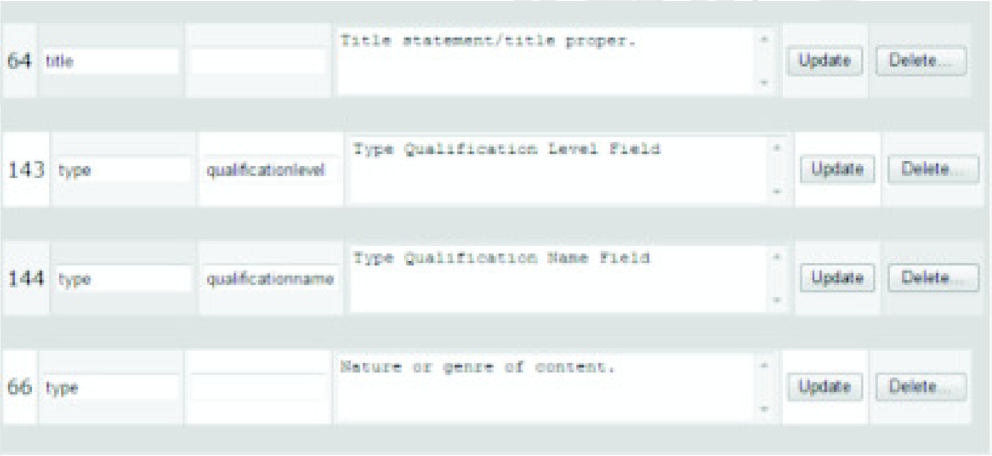
ID	Namespace	Name
1	http://dublincore.org/documents/dcmi-terms/	dc

Create a new schema by entering a namespace/name or edit an existing one by clicking the update button. The schema name must be less than 32 characters and cannot include spaces, periods or underscores.

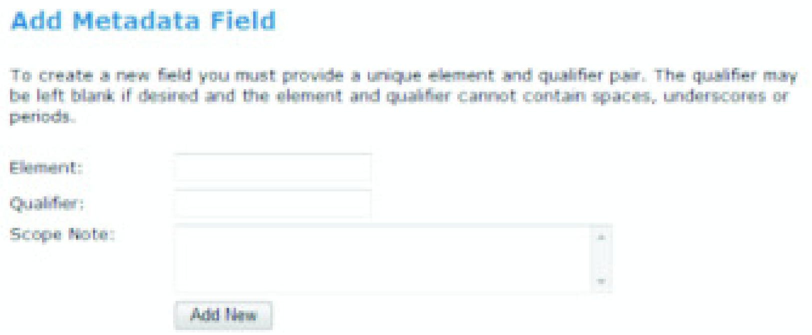
Namespace:

Name:

A schema can be edited and submitted using the 'Update' button, deleted using the 'Delete' button next to an element and new elements can be added using the 'Add Metadata Field' section at the bottom of the page



64	title		Title statement/title proper.	Update	Delete...
143	type	qualificationlevel	Type Qualification Level Field	Update	Delete...
144	type	qualificationname	Type Qualification Name Field	Update	Delete...
66	type		Nature or genre of content.	Update	Delete...



Add Metadata Field

To create a new field you must provide a unique element and qualifier pair. The qualifier may be left blank if desired and the element and qualifier cannot contain spaces, underscores or periods.

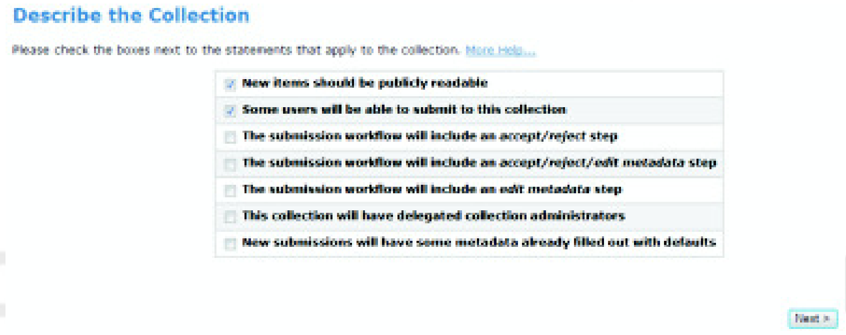
Element:

Qualifier:

Scope Note:

6) Item submission Workflow

In the 'Describe your Collection' step while creating a new collection, one can select different workflow steps. During the process of creating the collection you will then be asked to select users and groups to assign to the workflow stages you have selected.



Describe the Collection

Please check the boxes next to the statements that apply to the collection. More Help...

- ☑ New items should be publicly readable
- ☑ Some users will be able to submit to this collection
- ☐ The submission workflow will include an accept/reject step
- ☐ The submission workflow will include an accept/reject/edit metadata step
- ☐ The submission workflow will include an edit metadata step
- ☐ This collection will have delegated collection administrators
- ☐ New submissions will have some metadata already filled out with defaults

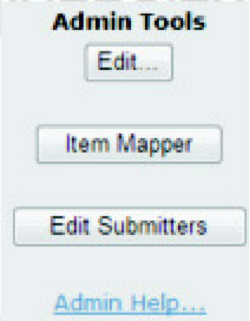
There are three options available for decision on the workflow:

- **Accept/Reject Step –** allows a user to simply accept an item, or reject it (with proper justification).
- **Accept/Reject/Edit Metadata Step –** allows a user to either accept or reject and item, and edit its metadata.
- **Edit Metadata Step-** allow the user to edit the metadata. This might be done to correct the metadata, or to improve it.

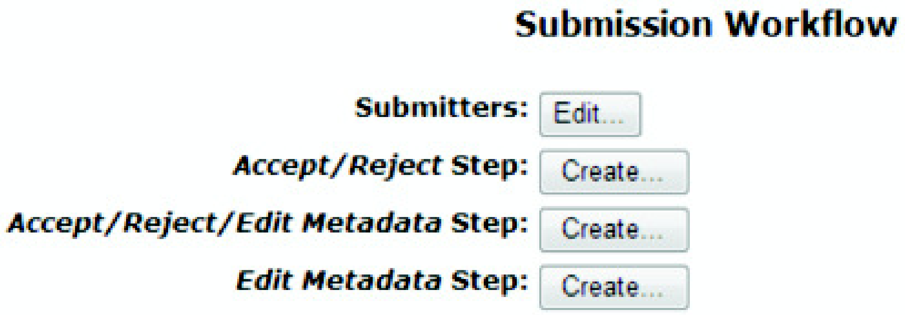
Any or all of the steps may be used. Workflow steps are worked through in order. If step 1 and 3 are selected, step 1 must be completed before step 3 will be initiated.

For an existing collection you may create the workflow through the following steps:

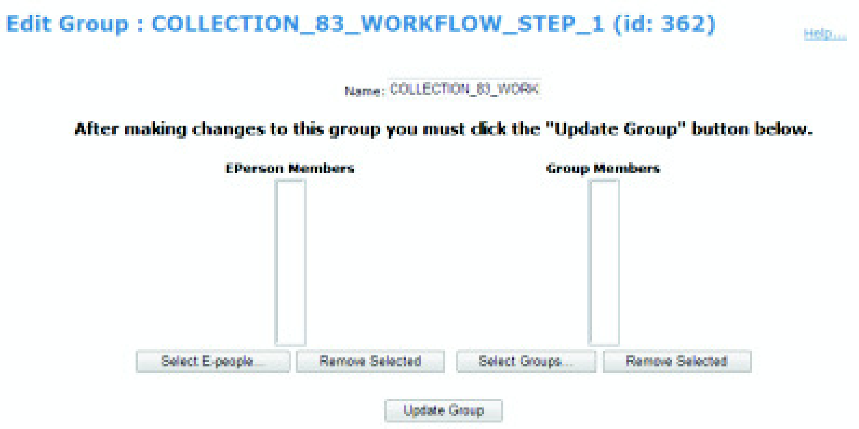
Log in as an administrator; go to the collection where you wish to create a workflow for. Click on the button 'Edit' in the 'Admin Tools' box.



Find the 'Submission Workflow' section, and click on whichever step you wish to create.


Submission Workflow
Submitters: Edit...
Accept/Reject Step: Create...
Accept/Reject/Edit Metadata Step: Create...
Edit Metadata Step: Create...

Edit the list of user and groups who can participate in the workflow as shown below:


Edit Group : COLLECTION_83_WORKFLOW_STEP_1 (id: 362)

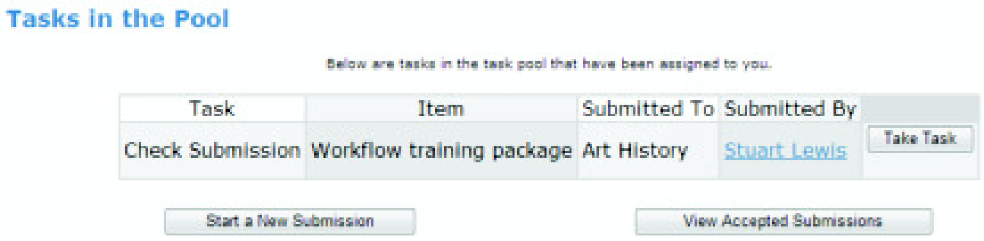
Name: COLLECTION_83_WORK

After making changes to this group you must click the "Update Group" button below.

When you have finished, press ‘Update Group’.

Use the same process to edit and delete workflow in a collection.

Once an item has entered into a workflow, the concerned users and group members will receive an email alert that there is a task awaiting attention. When a user visits their ‘My DSpace’ page they will see any tasks in the pool.

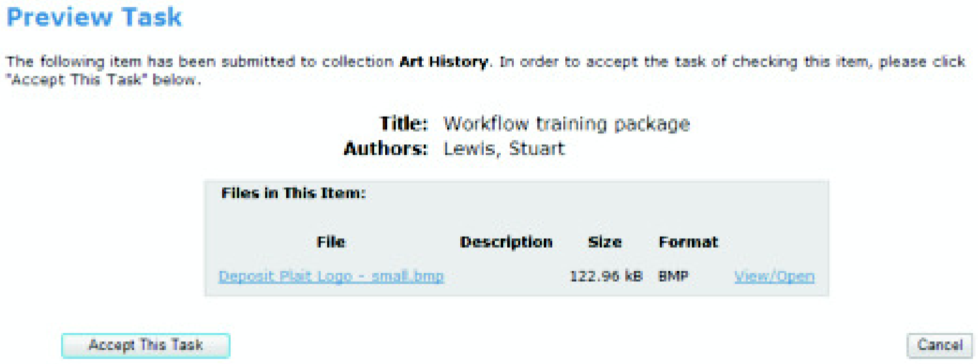


Tasks in the Pool

Below are tasks in the task pool that have been assigned to you.

Task	Item	Submitted To	Submitted By	
Check Submission	Workflow training package	Art History	Stuart Lewis	Take Task

On clicking on ‘Take Task’ the user gets an overview of the item take a decision whether they wish to take the task.



Preview Task

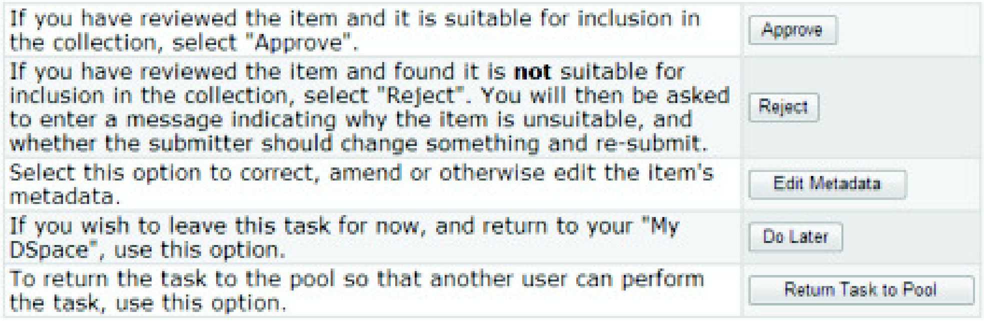
The following item has been submitted to collection **Art History**. In order to accept the task of checking this item, please click "Accept This Task" below.

Title: Workflow training package
Authors: Lewis, Stuart

Files in This Item:

File	Description	Size	Format	
Deposit Plait Logo - small.bmp		122.96 kB	BMP	View/Open

Clicking ‘Accept This Task’ will take the user into the workflow task page where they have several option for action such as, Approve, Reject, Edit Metadata, Do Later and Return Task to Pool.



If you have reviewed the item and it is suitable for inclusion in the collection, select "Approve".	Approve
If you have reviewed the item and found it is **not** suitable for inclusion in the collection, select "Reject". You will then be asked to enter a message indicating why the item is unsuitable, and whether the submitter should change something and re-submit.	Reject
Select this option to correct, amend or otherwise edit the item's metadata.	Edit Metadata
If you wish to leave this task for now, and return to your "My DSpace", use this option.	Do Later
To return the task to the pool so that another user can perform the task, use this option.	Return Task to Pool

7.5 SUMMARY

DSpace is a platform that allows you to capture items in any format – text, video, audio, and data and distribute it over the web. It indexes all the collection so that users can search and retrieve your items. It is best suited for preservation of digital work over the long term.

The Web-based interface of DSpace makes it easy for a submitter to create an archival item by depositing files. Data files, also called bitstreams, are organized together into related sets. Each bitstream has a technical format and other technical information. This technical information is kept with bitstreams to assist with preservation over time. An item in DSpace is an "archival atom" consisting of grouped, related content and associated descriptions (metadata). An item's exposed metadata is indexed for browsing and searching. Items are organised into collections of logically-related material.

In this Unit we have discussed in detail the technical features of DSpace along with the process of installation on your system and also using it for developing digital library.

7.6 ANSWERS TO SELF CHECK EXERCISES

1) The functional features of DSpace are:
   - Full-text search
   - Navigation
   - Supported file types
   - Optimized for Google Indexing
   - OpenURL Support
2) The prerequisite applications required for installation of DSpace are:
   - Java SDK (jdk-6u14-javafx-1_2-windows-i586)
   - PostgreSQL (8.x for Windows)
   - Apache Tomcat (apache-tomcat-5.5.28)
   - Apache Maven (2.2.1-bin)
   - Apache Ant 1.7.x.

7.7 KEYWORDS

Bitstream : a stream of data in binary form.

Checksum Checker : A checksum is a count of the number of bits in a transmission unit that is included with the unit so that the receiver can check to see whether the same number of bits arrived.

OpenURL : A standardised format of Uniform Resource Locator(URL) intended to enable Internet users to more easily find a copy of a resource that they are allowed to access.

7.8 REFERENCES AND FURTHER READING

The DSpace Course < http://cadair.aber.ac.uk/dspace/handle/2160/615>

DSpace Documentation <https://wiki.duraspace.org/display/DSDOC4x/DSpace+4.x+Documentation>

UNIT 8 CREATING DIGITAL LIBRARIES USING GSDL

Structure

8.0 OBJECTIVES

After going through this Unit, you will be able to:

- explain the technical features of Greenstone Digital Library (GSDL) Software;
- install GSDL on your system; and
- build a digital collection for the web as well as CD-ROM for your library.

8.1 INTRODUCTION

Greenstone is an *open-source*, multilingual software, issued under the terms of the GNU General Public License for building and distributing digital library collections. The aim of the Greenstone software is to empower users, particularly in universities, libraries, and other public service institutions, to build their own digital libraries. It provides a new way of organizing information and publishing it on the Internet or on CD-ROM in the form of a fully-searchable, metadata-driven digital library.

Greenstone has been produced by the New Zealand Digital Library Project at the University of Waikato, and is now being further developed and distributed in cooperation with UNESCO and the Human Info NGO in Belgium.

The exact user base for Greenstone is unknown. However, since it is being distributed on SourceForge, since November 2000, it has been found that the average downloads per month since then is around 4500.

The advantages of GSDL are:

- It is based on FOSS platform and has active community supporting it.
- It is Multi-platform application and can run on various operating system platforms, including Windows (any version), Linux, Sun Solaris, and Mac OSX. It is available in both binary (executable) and source code form for the Windows (all versions), Linux, and Mac OS X operating systems and in source code form for other operating systems (Unix).

- A Greenstone Collection can be served on the World Wide Web or it can be exported to a CD-ROM and accessed from the CD-ROM or local hard disc without the need for Internet connectivity.
- Greenstone can build indexes from full text documents and also metadata associated with these documents. It supports creation of indexes for various metadata fields, either automatically extracted or manually assigned.
- It uses Perl-scripting, MG(PP) or Lucene for indexing, Apache (or built-in webserver), XML, which are proven technologies
- Greenstone lets you build collections of multimedia documents such as audio, video, and pictures accompanied by textual description or metadata to allow searching and browsing.
- UNICODE compliant facilitating building, searching and browsing documents in any Unicode-compliant language.
- Separate modules are available for different uses:
  - JAVA-based interface for management
  - Web-browser based access to collections
  - CLI client : remote collection building
- Multi-metadata (with editor)
- Practical GLI interface for editing/managing GSDL
- Plug-ins for most document formats also available as well as for crosswalks for ISIS, Dspace, e-mails, MARC, MARCXML.

The Unit has been adapted from the Greenstone official documentation and the IMARK tutorial developed by FAO. Both the documents are available under the terms of either the GNU General Public License (http://www.gnu.org/licenses/gpl.html) and the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0/), for distribution and modification. The documents used are listed in the References and Further Readings section for further reference and you may refer them for further details.

8.2 TECHNICAL FEATURES

Multiplatform user friendly application

Greenstone runs on all versions of Windows, Unix/Linux, and Mac OS-X. The process of installation is quite simple. The default Windows installation does not require any configuration. End users routinely install Greenstone on their personal laptops or workstations. The Institutional users, however, generally run it on their main web server, where it interoperates with standard web server software i.e. Apache.

Interoperability

It is highly interoperable, based on contemporary standards. Greenstone can harvest documents over OAI-PMH and include them in a collection. Greenstone can ingest documents in METS (Metadata Encoding and Transmission Standard) form. This facilitates export and import of any collection to and from DSpace through DSpace batch import program.

Interfaces

Greenstone has two separate interactive interfaces, the Reader interface and the Librarian interface. End users access the digital library through the Reader interface, which operates within a web browser. The Librarian interface is a Java-based graphical user interface (also available as an applet) that makes it easy to gather material for a collection (downloading it from the web where necessary), enrich it by adding metadata, design the searching and browsing facilities that the collection will offer the user, and build and serve the collection.

Metadata formats

Users define metadata interactively within the Librarian interface. Unlike DSpace Greenstone allows several sets of metadata, including locally produced ones to be merged. The metadata sets are predefined:

- Dublin Core (qualified and unqualified)
- RFC 1807
- NZGLS (New Zealand Government Locator Service)
- AGLS (Australian Government Locator Service)

All metadata are stored in XML-format with the documents. Metadata can also be extracted from XML-statements within the documents It can be assigned easily through the GSDL Librarian interface using Greenstone's Metadata Set Editor. "Plug-ins" are used to ingest externally-prepared metadata in different forms, and plug-ins exist for: XML, MARC, CDS/ISIS, ProCite, BibTex, Refer, OAI, DSpace and METS.

Document formats

Plug-ins are also used to ingest documents. For textual documents, there are plug-ins for: PDF, PostScript, Word, RTF, HTML, Plain text, Latex, ZIP archives, Excel, PPT, Email (various formats), source code. For multimedia documents, there are plug-ins for: Images (any format, including GIF, JIF, JPEG, TIFF), MP3 audio, Ogg Vorbis audio, and a generic plug-in that can be configured for audio formats, MPEG, MIDI, etc.

Languages

One of Greenstone's unique strengths is its multilingual nature. The reader's interface is available in the following languages: Arabic, Armenian, Bengali, Catalan, Croatian, Czech, Chinese (both simplified and traditional), Dutch, English, Farsi, Finnish, French, Galician, Georgian, German, Greek, Hebrew, Hindi, Indonesian, Italian, Japanese, Kannada, Kazakh, Kyrgyz, Latvian, Maori, Mongolian, Portuguese (BR and PT versions), Russian, Serbian, Spanish, Thai, Turkish, Ukrainian, Vietnamese

The Librarian interface and the full Greenstone documentation (which is extensive) is in: English, French, Spanish, and Russian.

In GSDL the server (library.exe) uses PERL-scripts to create web-pages and forms to deal with the library of documents and its indexes. The documents are stored in their native format as such (PDF, DOC, HTML, XML etc.) which are converted ('imported') as XML in a collection with their text-only content. 'Plug-ins' for each type of content extract words from the documents and pass them onto the indexing engine. Metadata are also stored in XML. A web-interface allows searching, browsing results and opening full-text documents either in original or converted format.

There are three indexers available in GSDL:

- MG ('Managing Gigabytes') : at section level (=~field), Boolean or ranked
- MGPP : word level indexing (field, phrase + proximity) with Boolean+ranking
- Lucene (from the Apache SF) : field+proximity indexing but either on whole document or section, Boolean+ranking plus : single-character wildcards and range-searching; allows incremental collection building (not possible with MG(PP))

Unlike DSpace, GSDL allows several sets of metadata, including locally produced ones, even merged. Dublin Core (v.1.1) is provided together with RFC 1807, Development Library Subset, as well as LOM required for indexing learning objects. All metadata are stored in XML-format with the documents and can also be extracted from XML-statements within the documents. Metadata can be assigned easily through the GSDL Librarian interface. One limitation is that since GSDL does not use a DB for handling its XML-data, this imposes real limitations on speed.

Self Check Exercise

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

1) Enumerate technical features of GSDL.

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8.3 INSTALLATION OF GSDL ON WINDOWS

Before installing the software, be sure you have all the hardware and software requirements!

Hardware and software requirements

Storage requirements:

- 50MB for a binary installation
- 155MB for compiling Greenstone from source code
- 200MB for optional Greenstone demonstration collections
- 5MB for documentation
- 24MB for Greenstone's "CD exporting" function

Software:

- Java Run-time Environment (JRE) version 1.4 or above (Install JRE before installing GSDL) - JRE is required for GLI
- [Not required for default Windows installation] Web Server (Apache Recommended)
- PERL - gets installed automatically
- C++ compiler, if you wish to compile the source code (Visual Studio or GCC)
- A Web Browser

There are different options for getting the GSDL software:

1) UNESCO CD-ROM (version 2.70) or FAO IMARK CD-ROM,(but this is an earlier version 2.51) which contain the **Greenstone software**, plus **documented example collections**, four **language interfaces** (English French Spanish Russian), the **Export to CD-ROM**package, the **ImageMagick** graphics package, the **Java runtime environment**, and an **installer** that installs all of these.

2) IITE Digital Libraries in Education CD-ROM, or a Greenstone workshop CD-ROM. This *CD-ROMs* contains the tutorial exercises and a set of **sample files** to be used for these exercises apart from the requisite software listed above.

3) Download directly from http://www.greenstone.org that contains the latest version of Greenstone.

You will need **Java** to run Greenstone. You might already have itinstalled on your system otherwise, download it from http://java.sun.com. To work with image collections, you need **ImageMagick** (fromhttp://www.imagemagick.org).

Most Greenstone CD-ROMs have AutoPlay feature and start the installation process as soon as they are inserted into the drive. If installation does not begin by itself, locate the file *setup.exe* and double click it to start the installation process.

If you download Greenstone over the web then just double-click installer.

If Greenstone is already installed on your system then completely remove the old version before installing a new one. You need not remove any pre-packaged collections that you may have installed for this.

The following steps need to be carried out to install Greenstone:

1) Install the Java 2 Runtime Environment (latest version).
2) After installing J2RE, go for GSDL folder choose setup gsdl 2.70.
3) Choose setup Language. English (US) is the default. We choose **English**
4) Welcome to the InstallShield Wizard for the Greenstone Digital Library Software. Click **<Next>**
5) License Agreement. Accept the agreement and then click **<Next>**
6) Choose location to install Greenstone. Leave at the default and click **<Next>**
7) Setup Type. Leave at the default (Local Library) and click **<Next>**

8) (For older installers you must now select collections. Leave at the default, Documented Example Collections, and click <**Next**>)

9) Set admin password. Choose a suitable password and click <**Next**> (If your computer will not be serving collections online, the password doesn't matter)

10) Click <**Install**> to complete the installation

11) Files are copied across and Installation is complete.

If you are installing from a CD-ROM, the installer will offer to install ImageMagick, and Java, if necessary.

To invoke the Greenstone Reader's interface, go to the Greenstone Digital Library Software item under Programs on the Windows Start menu and select Greenstone Digital Library. To invoke the Librarian interface, go to the same item and select Greenstone Librarian Interface.

Installing ImageMagick on a Windows system

Once Greenstone has been installed, ensure that ImageMagick is installed on your system, if you wish to build any image collections. If you are installing from a Greenstone CD-ROM, you will be asked whether you want to install ImageMagick: say **Yes**. If you are not, you will need to download ImageMagick (from http://www.imagemagick.org). To install this program you must have Windows "Administrator" privileges.

The remaining steps are straightforward, and, as before, it is recommend that you use the default settings. Here is what you need to do for installing ImageMagick:

1) "This will install ImageMagick 5.5.7 Q8. Do you wish to continue?" **Yes**

2) "Welcome to the ImageMagick Setup Wizard" Click <**Next**>

3) "Information: Please read the following ..." Click <**Next**>

4) "Select Destination Directory ..." Leave at default and click <**Next**>

5) "Select Start Menu Folder ..." Leave at default and click <**Next**>

6) "Select Additional Tasks ..." Leave at default and click <**Next**>

7) "Ready to Install". Click <**Install**>

8) Files are copied across

9) "You have now installed ..." Click <**Next**>

10) "Setup has finished ...". Deselect "View index.html" and click <**Finish**>.

8.4 GREENSTONE INTERFACES

GSDL comprises two interfaces, the Librarians Interface and the Website which serves as the user interface.

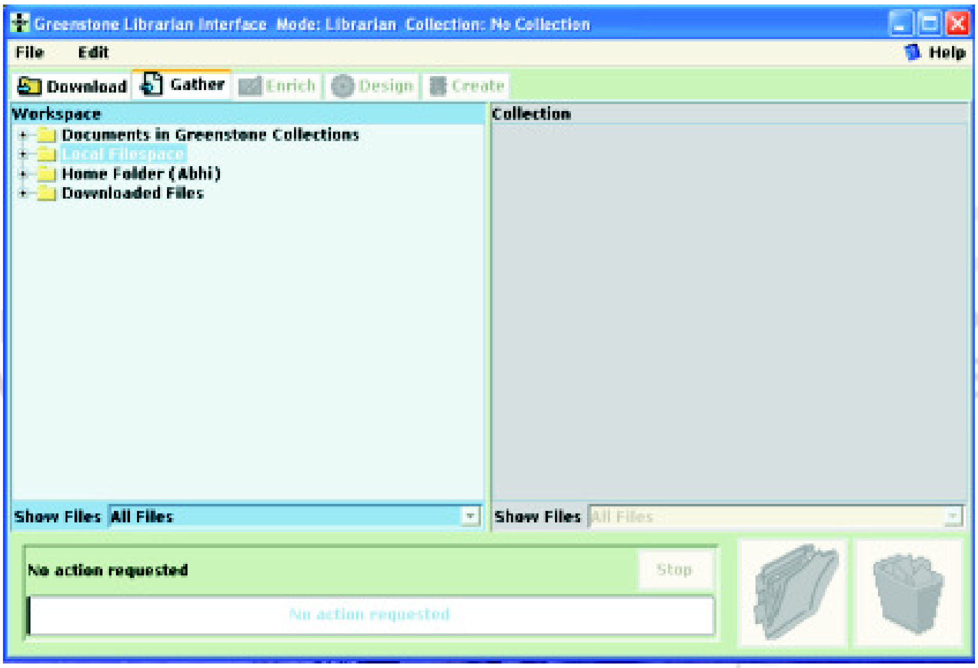
The "librarian's interface" in GSDL is for creation, management and updating collections. It is programmed in JAVA highly based on creation of the necessary commands.

The website is served by internal www-server or Apache. Webpages are created by Perl and Java Servlets which is customisable via CSS and text-files.

A) Librarian's Interface

A JAVA-PERL applet (gliserver.pl) provides an interactive graphical interface for the Greenstone Librarian Interface with the following main functions :

1) **Gathering**- documents into a Selecting files from 'local file space' or Local Network or downloading using protocols viz. WWW, OAI (Open Archives Initiative), Z39.50, SRW (Search and Retrieve Web service), MediaWiki.

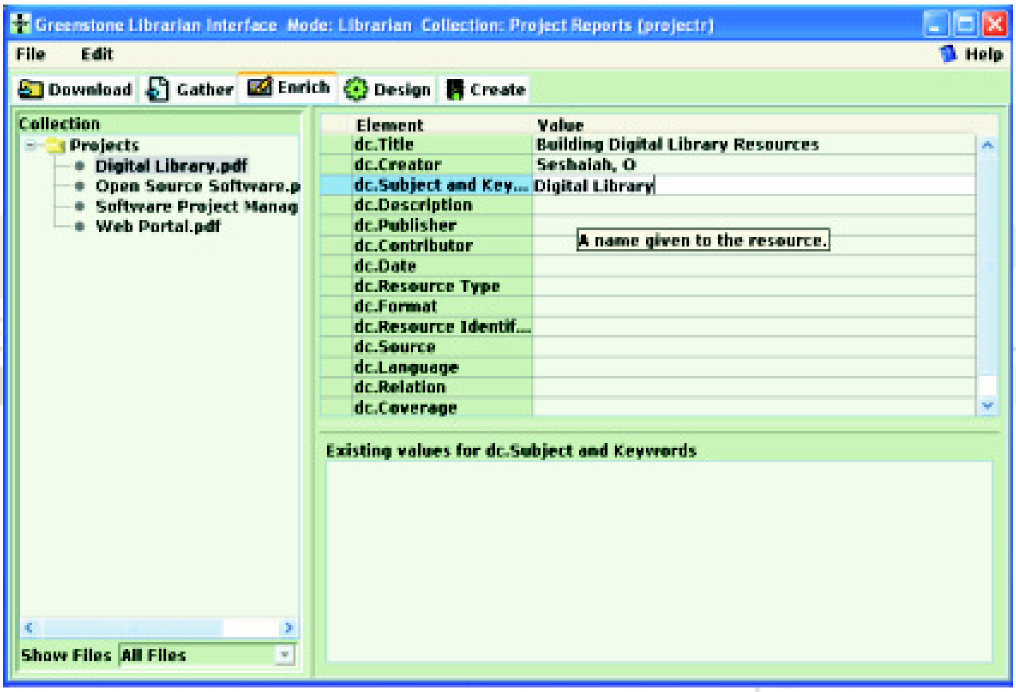


No action requested

No action requested

Fig. 8.1: Librarian's Interface- Collection Building

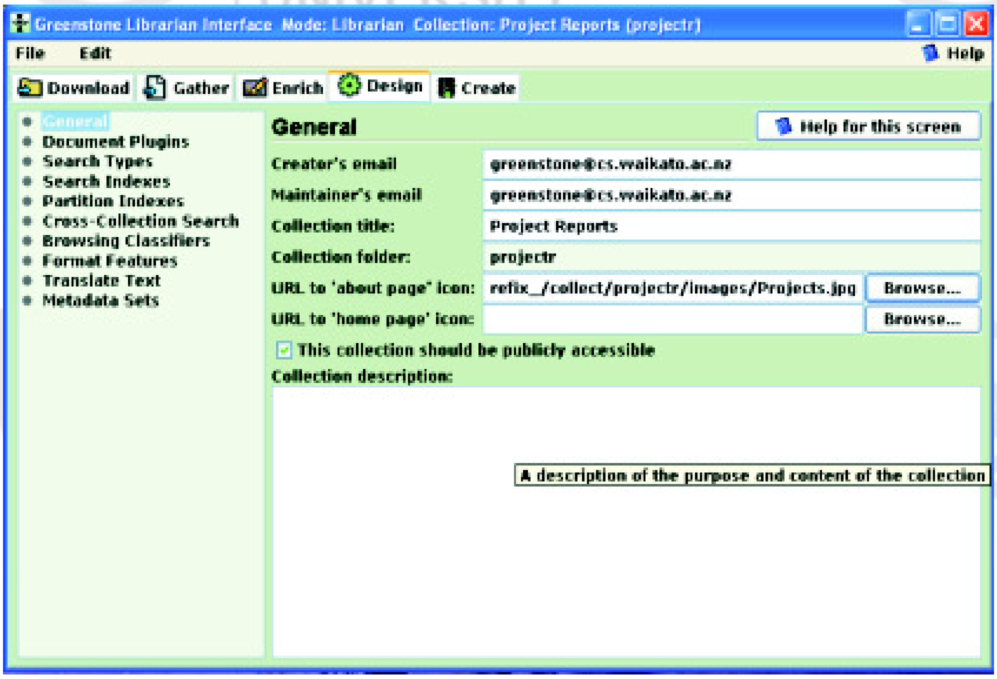
2) **Enriching** - cataloguing with metadata, i.e. assign values to metadata-fields -Dublin Core and/or others or local sets. Metadata editor allows creating/ changing sets and assigning values- automatic inheriting for lower levels, multiple values, picklists or hierarchical at level1|level2|level3



Element	Value
dc.Title	Building Digital Library Resources
dc.Creator	Seshaiah, O
dc.Subject and Key...	Digital Library
dc.Description	
dc.Publisher	
dc.Contributor	
dc.Date	
dc.Resource Type	
dc.Format	
dc.Resource Identif...	
dc.Source	
dc.Language	
dc.Relation	
dc.Coverage	

Fig. 8.2: Librarian's Interface- Metadata Input

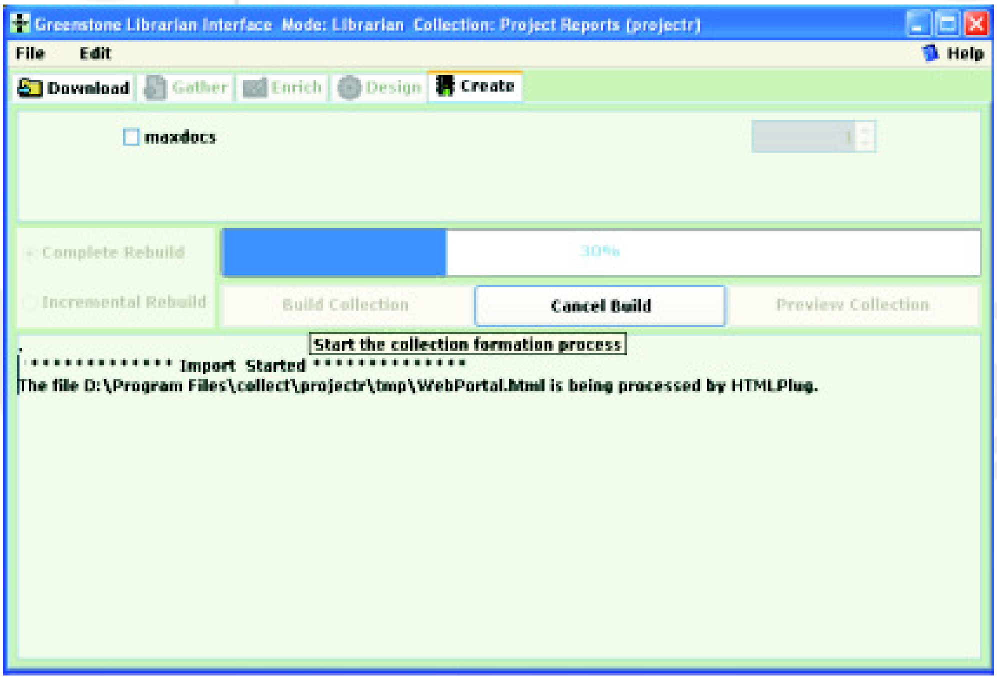
3) **Design** – this involves selection of plugins (e.g. GA, TEXT, PPT, Word, PDF, RTF, e-mail, XLS, Fox, DB, as well as ISIS, DSpace, MARC, ProCite…), defining Search index, Partitioning of sub-collections and setting Browsing classifiers, hierarchical or A-Z.



Creator's email: greenstone@cs.waikato.ac.nz
Maintainer's email: greenstone@cs.waikato.ac.nz
Collection title: Project Reports
Collection folder: projectr
URL to 'about page' icon: refix_/collect/projectr/images/Projects.jpg
URL to 'home page' icon:
☑ This collection should be publicly accessible
Collection description:
A description of the purpose and content of the collection

Fig. 8.3: Librarian's Interface- designing

4) 'plug-ins' (filters), Indexing the documents and providing preview facility for direct access to webpage with search-interface produced by GLI is done at this stage. Once build is successful then the collection needs to be linked to previewing.



□ maxdocs

```
************* Import Started *************
The file D:\Program Files\collect\projectr\tmp\WebPortal.html is being processed by HTMLPlug.
```

Fig. 8.4: Librarian's Interface- publishing

Self Check Exercise

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

2) What functions are available in the Librarian's Interfce?

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B) Greenstone User Interface

Although the user interface of different Greenstone collections may appear remarkably similar, each one can provide varying search, browse and display features, depending on access requirements, nature of documents comprising the collection and metadata associated with these documents. As a digital library developer you can define the desired end-user interface features for your collection at the designing stage.

Collection Searching

Greenstone supports different ways of searching collections. They can be grouped in two main categories: "plain search" (through Google-like single search box) and "form-based search".

- **Plain search:**

  Simple - Users can search for words or phrases in the full text of the document or limit the search to a specific index (e.g. document title or author) by selecting the available index from the drop-down box.

  Advanced- Boolean queries.

- **Form-based search**

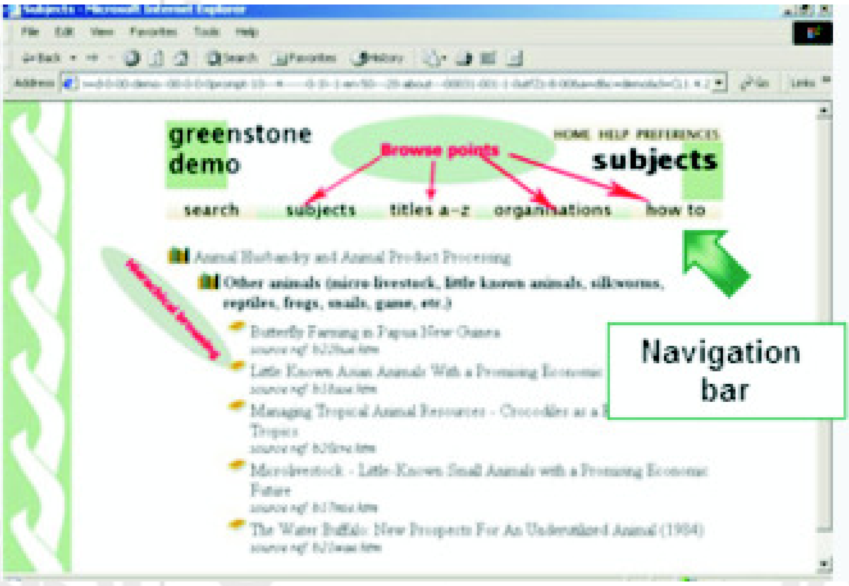
  Simple - Users can search for words or phrases across different fields.

  Advanced - Users can search for words or phrases across different fields, with support for Boolean query combination, case folding and stemming.

Document Browsing

Greenstone supports browsing of documents in a collection by specific metadata fields.

Available browse elements for a collection are shown on the navigation bar in the collection home page. Hierarchical browsing of classification-like structures (e.g. a subject classification) with different levels is possible.



Animal Husbandry and Animal Product Processing

Other animals (micro-livestock, little known animals, silkworms, reptiles, frogs, snails, game, etc.)

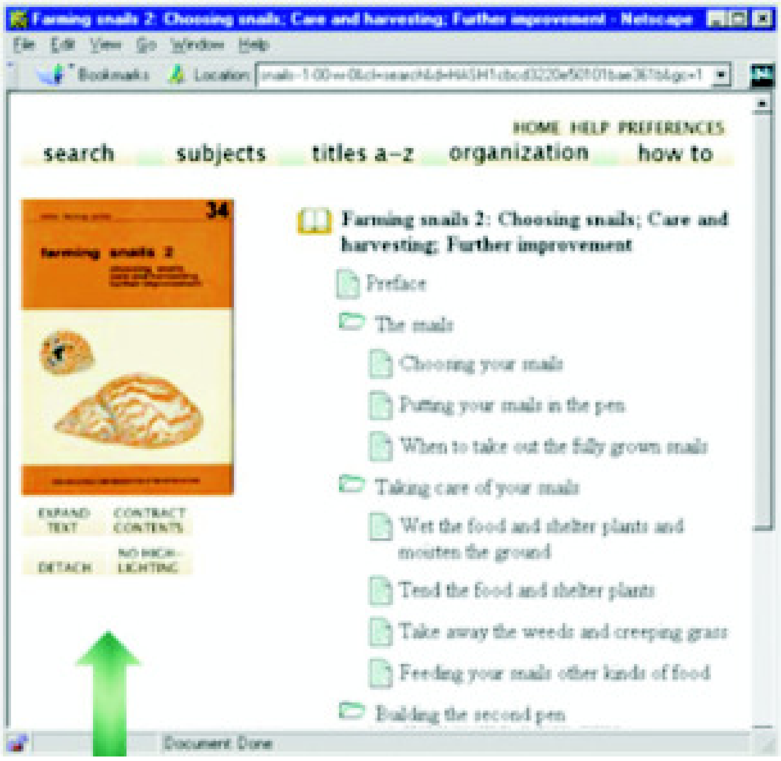
- Butterfly Farming in Papua New Guinea
- Little Known Asian Animals With a Promising Economic
- Managing Tropical Animal Resources - Crocodiles as a R… Tropics
- Microlivestock - Little-Known Small Animals with a Promising Economic Future
- The Water Buffalo: New Prospects For An Underutilized Animal (1984)

Fig. 8.5: User Interface- document Browsing

Presentation of Search Results

The web pages the users see when using Greenstone are not pre-stored but are generated "on the fly" as they are needed. This includes the way the browse and search results appear and individual documents are presented. After obtaining a document (selected from results of browse/search), a user can:

- view complete content or contract it (in a full-text tagged document);
- highlight matching search terms or not; and
- detach the document for viewing in a different window.



Farming snails 2: Choosing snails; Care and harvesting; Further improvement

- Preface
- The snails
  - Choosing your snails
  - Putting your snails in the pen
  - When to take out the fully grown snails
- Taking care of your snails
  - Wet the food and shelter plants and moisten the ground
  - Tend the food and shelter plants
  - Take away the weeds and creeping grass
  - Feeding your snails other kinds of food
- Building the second pen

Fig. 8.6: User Interface- document Presentation

Greenstone supports multilingual interface. Through the preferences setting, the user can change the language of the Greenstone interface. It can also support indexing and searching of document collections in non-Latin scripts.

8.5 COLLECTION BUILDING IN GREENSTONE

You will need some source files like those in the sample_files\Word_and_PDF folder to work on the collection building.

1) Start a new collection called **reports**, fill out appropriate fields for it, and choose Dublin Core as the metadata set.

2) Copy the 12 files from *sample_files '! Word_and_PDF '! Documents* into the collection. You can select multiple files by clicking on the first one and shift-clicking on the last one, and drag them all across together. (This is the normal technique of multiple selection.)

3) Switch to the **Create** panel, and **build** and **preview** the collection.

4) Again, this collection contains no manually assigned metadata. All the information that appears—title and filename—is extracted automatically from the documents themselves. Because of this the quality of some of the title metadata is suspect.

5) Back in the Librarian Interface, click the **Enrich** tab to view the automatically extracted metadata. You will need to scroll down to see the extracted metadata, which begins with "ex.". The PostScript documents (*cluster.ps* and *langmodl.ps* do not have extracted titles: what appears in the *titles a-z* list is just the first few characters of the document).

6) **Manually adding metadata to documents in a collection**

   In the **Enrich** panel, manually add Dublin Core *dc.Title* metadata to one of these documents. Select *word03.doc* and double-click to open it. Copy the title of this document ("Greenstone: A comprehensive open-source digital library software system") and return to the Librarian Interface. Scroll up or down in the metadata table until you can see **dc.Title**. Click in the value box, paste in the metadata and press **Enter**.

7) Now add *dc.Creator* information for the same document. You can add more than one value for the same field: when you press **Enter** in a metadata value field, a new empty field of the same type will be generated.

8) Close the document when you have finished copying metadata from it. External programs opened when viewing documents must be closed before building the collection, otherwise errors can occur.

9) Next add title and creator metadata for a few of the other documents.

   If you build and preview your collection at this point, you will find that nothing has changed. You need to alter the collection design to use the new Dublin Core metadata instead of the original extracted metadata.

10) **Collection design; branding a collection with an image**

Change to the **Design** panel, which is split into several sections. The first section **General** appears. This allows you to modify the values you provided when defining the collection, if desired. You can also brand the collection using a suitable image.

11) Click on the **<Browse...>** button associated with **URL to about page icon**, and browse to the image *sample_files '! Word_and_PDF '! wrdpdf.gif* on your computer. When you select this image, Greenstone automatically generates an appropriate URL for the image. **Preview** the collection.

If you are on the web, you can easily make your own Greenstone-style icon by going to and following the instructions there.

http://www.greenstone.org/make-images.html

Document plugins

12) Now look at the **Document Plugins** section, by clicking on this in the list to the left. Here you can add, configure or remove plugins to be used in the collection. There is no need to remove any plugins, but it will speed up processing a little. In this case we have only Word, PDF, RTF, and PostScript documents, and can remove the ZIPPlug, TEXTPlug, HTMLPlug, EMAILPlug, ImagePlug, ISISPlug and NULPlug plugins. To delete a plugin, select it and click **<Remove Plugin>**. GAPlug is required for any type of source collection and should not be removed.

13) **Search types and fielded searching**

Go to the **Search Types** section. This specifies what kind of search interface and what search indexes will be provided for the collection. Let's add a form search option. Click **<Enable Advanced Searches>**; this allows form searching to be added to the collection.

14) To include "form search" as well as the default "plain search", pull down the **Search Types** menu and select **form**; then click **<Add Search Type>**.

Plain search will be the default search type as it is first in the list.

Search indexes

15) The next step in the **Design** panel is **Search Indexes**. These specify what parts of the collection are searchable (e.g. searching by title and author). Delete the *ex.Title* and *ex.Source* indexes, which are not particularly useful, by selecting them one at a time and clicking **<Remove Index>**. Only the *text* index remains.

16) Now add a Title index based on *dc.Title* by providing an **Index Name** (e.g. "Document Title") and selecting *dc.Title* from the **Index Source** box. Then click **<Add Index>**.

17) You can add indexes based on any metadata. Add an index called "Authors" based on *dc.Creator* metadata.

*The next two sections are **Partition Indexes** and **Cross-Collection Search**. In this exercise, we will not make any changes to these.*

18) The **Browsing Classifiers** section adds "classifiers," which provide the collection with browsing functions. Go to this section and observe that Greenstone has provided two classifiers,*AZLists* based on *ex. Title* and *ex. Source* metadata. Remove both of these by selecting them in turn and clicking **<Remove Classifier>**.

19) Now we add an *AZList* classifier for *dc.Title* metadata. Select *AZList* from the **Select classifier to add** drop-down list and click **<Add Classifier>**

20) A popup window **Configuring Arguments** appears. Select *dc.Title* from the **metadata** drop-down list and click **<OK>**.

21) Now add an *AZCompactList* classifier. Click **<Add Classifier>** and configure it to use *dc.Creator* metadata, with button name "Creator". Click **<OK>**.

    *The last three sections are **Format Features**, **Translate Text** and **Metadata Sets**. In this exercise, we will not make any changes to these.*

22) Switch to the **Create** panel, and **build** and **preview** the collection.

23) Check that all the facilities work properly. There should be three full-text indexes, called *text*, *Document Title*, and *Authors*. In the *titles a-z* list should appear all the documents to which you have assigned *dc.Title* metadata (and only those documents). In the *authors a--z* list should appear one bookshelf for each author you have assigned as *dc.Creator*, and clicking on that bookshelf should take you to all the documents they authored.

In the similar fashion you can build up collection for other types of file formats. For details visit the tutorial site of Greenstone.

8.6 SUMMARY

Greenstone is a freely available open source software for building and distributing digital library collections through Internet or. Multiplatform availability, the capability of providing access in different ways and managing different file formats, media and languages are some of the major advantages of Greenstone. The Librarian Interface provides the most advanced and at the same time a very user friendly approach to collection building and also metadata management.

In this Unit we discussed the technical features of Greenstone, installation process and building a digital library.

8.7 ANSWERS TO SELF CHECK EXERCISES

1) Technical features of GSDL are:

    - Multiplatform user friendly application
    - Interoperability
    - Independent librarian and user interfaces
    - Supports variety of Metadata formats
    - Supports variety of Document formats
    - Supports multiple Languages

2) Following functions are available in the Librarian's Interface:

- Creation of New Collection
- Selection Metadata
- Gathering
- Enrich
- Design
- Create

8.8 KEYWORDS

Lucene	:	Open source search engine.
Perl	:	A script programming language that is similar in syntax to the C language and that includes a number of popular UNIX facilities.
UNICODE	:	An international encoding standard for use with different languages and scripts, by which each letter, digit, or symbol is assigned a unique numeric value that applies across different platforms and programs.
XML	:	Extensible Markup Language (XML) is a markup language that defines a set of rules for encoding documents in a format which is both human-readable and machine-readable.

8.9 REFERENCES AND FURTHER READING

FAO IMARK Tutorial < http://www.imarkgroup.org/#/imark/en/course/H>

Greenstone - Configuration files of demo collections in New Zealand Digital Library project www.nzdl.org: <http://www.greenstone.org/cgi-bin/library?a=colcfg>

Greenstone training workshop material. Greenstone Digital Library Project and NCSI, IISc. <http://www.greenstone.org/>

Customizing the Greenstone User Interface. An illustrated guide to customizing the Greenstone user interface. Written by Allison Zhang of the Washington Research Library Consortium <http://www.wrlc.org/dcpc/UserInterface/interface.htm>

Witten, Ian H. and Bainbridge, David (2003). How to build a digital library. Morgan Kaufman Publishers. Print

Witten, Ian H. (2003). Examples of practical digital libraries: Collections built internationally using Greenstone. D-Lib Magazine, March. <http://dlib.org/dlib/march03/witten/03witten.html>