Interoperability Among University Libraries in Bangladesh: Data Exchange Feasibility

Thesis submitted to the Department of Information Science and Library Management, University of Dhaka, as a partial fulfillment of the requirement for the degree of Master of Arts of the year 2012.

Submitted by-
Examination Roll No. 3035
Registration No. HA-5912
Examination Session: 2011-2012

Department of Information Science and Library Management
University of Dhaka
March 2014

Interoperability Among University Libraries in Bangladesh: Data Exchange Feasibility

<u>STUDENT DECLARATION</u>

I do hereby solemnly declare that the thesis entitled "Interoperability Among University Libraries in Bangladesh: Data Exchange Feasibility" is an original work done by me under the supervision of Dr. Md. Saiful Alam, Professor, Department of Information Science and Library Management, University of Dhaka. This thesis or any part of it has not been submitted elsewhere for the award of any degree.

………………………………….
Suzon Chandra Das
Examination Roll No. 3035
Registration No. HA-5912
Examination Session: 2011-2012
Department of Information Science and Library Management
University of Dhaka

CERTIFICATE

I have the pleasure to certify that the thesis entitled "Interoperability Among University Libraries in Bangladesh: Data Exchange Feasibility" submitted by Suzon Chandra Das, Examination Roll No. 3035, for the degree of Master of Arts in Information Science and Library Management, University of Dhaka, is his original work carried out under my supervision and is worthy of examination.

....
Dr. Md. Saiful Alam
Professor,
Dept. of Information Science and Library Management,
University of Dhaka.

Abstract

Libraries have been cooperating and collaborating on collection building and resource sharing for many years. The cooperation was based on inter-library loan and preparation and publication of union catalogue. In Bangladesh, the ways of cooperation in building resources and access to information resources was not easy and effective in manual way. Since last decade, due to rapid emergence of ICTs in Library field, ways of library resource building and resource sharing have become more easier and efficient than manual way. In the digital era, the term "Interoperability" has become main focusing issue in the field of library resource sharing or information exchange. But questions have been arisen when libraries started to computerize their bibliographic information using different platforms. When the libraries using different platforms, i.e.- Integrated Library System, Single Alone Software, simple Script Language, etc., try to interoperate among themselves, data exchange feasibility becomes main issue. There are many International Standards in developing Online Public Access Catalogue (OPAC) followed by different libraries in Bangladesh which create major barriers in building interoperability because of inconsistency among themselves. This study was carried out to identify the data exchange feasibility among the university libraries, to show how the inconsistency among different platforms can be removed and thus how university libraries can join in a uniform platform.

In the study those university libraries were selected as sample which are in front position in applying ICTs in their work settings. These selected libraries represents most of the automated university libraries in Bangladesh. A questionnaire was developed based on the present ICTs trends in university libraries. This questionnaire judges the capability of the libraries to be interoperable through Z39.50/SRW protocol. This protocol was in main concern when developing the interoperability model. In the study, 7 libraries were found that can create MARC format records. These libraries can directly host bibliographic records into Z39.50 Server. The rest libraries cannot produce MARC format records, but follow MARC fields in catalogue data entry. To convert the bibliographic records of these university libraries into MARC format, MARCedit tool was used. After converting into MARC format, these records can be hosted in Z39.50 Server. Thus, we can achieve our desirable interoperability among most of the automated university libraries in Bangladesh.

The present study has been discussed under Six broad chapters. The first chapter discusses the background, objectives, scope, methodology and limitation of the study. The second chapter contains the Theoretical Introduction of Interoperability, MARC21 and Z39.50/SRW while the third chapter discusses about the literature reviewed for the study.

The fourth chapter describes how and which sample libraries have been selected for the study. The fifth chapter shows the findings of the survey and presentation of analyzed data. The final chapter shows the recommended interoperability model, data conversion technique and guidelines for the library to be interoperated.

The findings and recommendations from the study should hopefully lead to a clarification of many problems in the formulation of planning and policy making regarding interoperability among automated libraries in Bangladesh. It is assumed that it would help the librarians, policy makers and concerned authority to develop and implement a suitable system to accelerate automated library resource sharing activities in Bangladesh.

However, all the possible investigations have been made to collect data related to the study in order to give a complete picture. It may be useful as a basic work for future investigators. If the work is found useful to the planners, librarians and information specialists, the efforts undertaken would be successful.

Suzon Chandra Das

ACKNOWLEDGEMENTS

It would not have been possible to write this thesis without the help and kind supports I received from people around me.

First I would like to express my deepest sense of gratitude and sincere acknowledgement to my supervisor Dr. Md. Saiful Alam, Professor, Department of Information Science and Library Management, University of Dhaka, for his constant supervision, valuable advices and inspiration in every stages of this research. Without his full supports it was not possible for me to complete this work.

My sincere gratitude goes to all of my respected teachers of the Department of Information Science and Library Management, University of Dhaka for their cooperation, suggestions and guidance to complete the thesis perfectly.

In pursuing the study, I had to depend on different public and private university libraries. I am grateful to the librarians and information professionals of those public and private university libraries who provided me necessary information and extended all possible helps for this work. I owe my deepest gratitude to the authors whose work I have used in this study as I had to depend on different national and international publications for the completion of thesis.

I am deeply grateful to my father and my mother whose scarifies, prayers and persistent support made it much easier to accomplish this work. I owe all of my beloved brothers and friends a great debt of gratitude, as well, for their unlimited support and encouragement all along. Above all, I am deeply grateful to Almighty, the Most Gracious and Most Merciful, for giving me mental power and ability to accomplish this study.

Suzon Chandra Das

Table of Contents

List of Tables

List of Figures

Chapter 1

Introduction

Chapter 1

Introduction

1.1 Background :

Libraries have been cooperating and collaborating on collection building for many years. The main objective of library cooperation and resource sharing is to maximize the availability of and access to information and services at a minimum cost (Mannan, 1998). These activities were not easy and efficient in manual way. Due to the emergence of Information and Communication technologies , Library cooperation got new dimension in achieving its goal. The ways and means of creating, accessing, distributing and managing information not only text but other forms such as audio-video and multimedia materials have undergone major changes. Consequently, data exchange feasibility become the major issue for library cooperation and resource sharing(Chan, 2006). In the digital arena, library collaboration and resource sharing depends upon the interoperability capacity of the participating libraries. That's why data exchange feasibility becomes the focusing point when libraries try to interoperate among themselves.

1.2 Rationale of the study :

Due to information explosion, automation of library services is imperative for efficiency and effective working of library and information centre (Singh, 2010). They are now being treated as digital or automated library. They are trying to use ICTs in every sector of library, i.e.- acquisition, processing, circulation, serial control, etc. In Bangladesh library automation is being practiced since last decade. Now, 17% private and public university libraries are well automated in different fields of library. The number of this ratio is about 30. Four private university libraries are fully automated whereas, the other 27 libraries are on the way to be automated (Rezaul, 2012). Some platforms are open source and some others are proprietary. When the automated libraries try to be interoperable among themselves these platforms become crucial points. The variety of automation platforms also influences interoperability among these libraries (Zeng, 2001). To exchange resources among the libraries these different types of platforms should be analyzed, data exchange feasibility should be measured, a common platform should be provided to interoperate without interfering their existing platforms. Though in Bangladesh library automation is being practiced since many years, there is no national policy or guideline to follow in library automation. That's why university libraries in Bangladesh are using different automation platforms and metadata scheme regardless of mutual uniformity. When these

libraries try to be interoperable, the inconsistency of uniformity in metadata scheme and automation platform create major barriers. There is no research conducted regarding data exchange feasibility among these libraries yet. In removing the inconsistency and providing a model framework to interoperate regardless different metadata scheme and platforms, there is no study conducted yet also. Many Libraries are creating their bibliographic databases without keeping in mind the interoperability aspect. When these libraries will go for interoperability action, they will have to suffer much. Either they will have to rebuild their collection databases or they will have to be in the sideline of the interoperability consortia. Therefore, we felled strong need to conduct research regarding measuring the data exchange feasibility among these libraries and preparation for a interoperability model.

1.3 Objectives of the study :

The study was conducted to achieve the following objectives:

1. To identify and measure the data exchange feasibility among selected representing university libraries both private and public.

2. To analyze the interoperability capacity of selected university libraries focusing on Z39.50 protocol.

3. To recommend a common interoperability model for the university libraries that use different platforms and tools in developing their bibliographic databases. By applying this model, the libraries having no direct Z39.50 appliance will be able to convert their existing databases into MARC format databases in order to exchange their data using common interoperability protocol – Z39.50/SRW.

1.4 Scope of the study :

The need and importance of use and application of information and communication technology (ICT) in the university libraries of Bangladesh have already been realized, and beginning has already made by the major public and private universities, such as DU, BUET, EWU, BRACU, and IUB. In the country, Libraries are being automated through different platforms. These platforms varies from one another in the view of information architecture. When these libraries try to interoperate among themselves, the difference in information architecture create major problems. 70 Percent automated university libraries follow MARC21 fields in developing their bibliographic database. In the present study we selected ten (10) university libraries that follow MARC21 in building bibliographic records of their collection. A questionnaire was developed to survey these libraries to identify the

data exchange feasibility. We proposed Z39.50 protocol as interoperability platform for these libraries. Based on the findings from surveyed questionnaire, it was found that 7 sample libraries can produce direct MARC file that is used to host bibliographic records in Z39.50 protocol. One library can produce MARC record but not registered as Z39.50 client. Other two (2) libraries cannot produce MARC file, but follow MARC fields in data entry of the catalogue. For the libraries that are not direct Z39.50 applicant, a common model was recommended. When these all sample libraries get connected through common protocol, we achieve our study objectives.

1.5 Methodology :

The choice of an appropriate research methodology is important for any research study. Authentic research findings need sound scientific methodology. In the present study, the following methodology has been adapted:

1.5.1 Design of study:

1 • Literature Review

2 • Theoretical Introduction to Interoperability, MARC 21 and Z39.50/SRW

3 • Selection of Sample Libraries and Survey

4 • Findings

5 • Development of Interoperability Model and Recommendations
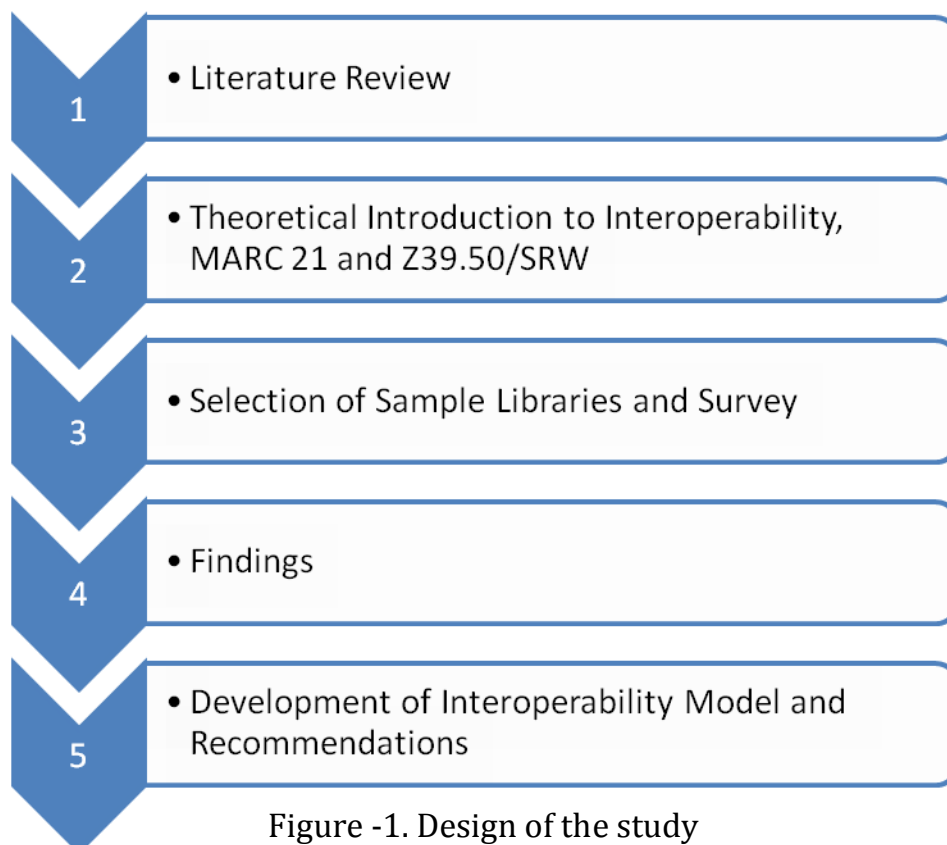
Figure -1. Design of the study

1.5.2 Literature Review

The amount of literature in field of Interoperability and data exchange feasibility among libraries is comparative less than other fields due to its late emergence. But the amount is growing dramatically day by day. The study covers those research works that could strongly help us in achieving our research study. This study is greatly grateful to some prominent scholarly articles published in world renown publishers. In the Literature review chapter those documents are cited with the facts found helpful for the present study. The complete citation of these works are given at the end of the study.

1.5.3 Sample Design

For ensuring representativeness from public and private university libraries and 10 public and private university libraries of the country were purposefully selected and brought under investigation based on their ranking and application of ICTs in their work settings. In the selection process, the capability of producing MARC format records was in main consideration. Among the sample libraries, 7 libraries can directly produce MARC records, 1 library can produce MARC record but not registered as Z39.50 client and other 2 cannot produce MARC record, but follow MARC fields in their data entry of catalogue.

1.5.4 Data Collection

The selected libraries brought under survey based on a questionnaire which is appended at the end of the paper. The questions were designed based on the current automation trend in Bangladesh, development of ICTs and socio cultural aspects in library work settings. It focused on the software, hardware issues in the automation project for getting clear view of existing database structure and schema of the libraries.

Besides the questionnaire method, some information were collected using freely available applications and tools such as-

i. For identification Server : HTTP header, a Firefox add-on.
ii. For identification of Script Language and Database : HAVIJ, an free tools. Available at http://*www.havij1-17.com/*
iii. For identification of KOHA version : HTML Header tag analysis by reading OPAC site's source code.

1.5.5 Data Analysis:

Data from surveyed questionnaire were analyzed based on some common factors, i.e.- MARC record creation capacity, Quality of MARC entry, Z39.50/SRW appliance, etc. Collected data from different libraries brought under data mining approach. These grouped data were further analyzed for proposing a common platform for interoperability.   In data analyzing process, *MS Excel* software was used.   In Interoperability Model preparation process, Integrated Library System(ILS) KOHA v. 3.1 was also used.

1.5.6 Data Presentation:

In the study data are presented appropriately using different tools. MS Excel was used to present statistical data Graph and tables. Adobe Photoshop was used for graph and figure preparation.

1.5.7 Development of Interoperability Model and Recommendation:

In implementation phase a model of interoperability is designed out based on the common issues in selected libraries. In development of Interoperability model we have proposed Z39.50/SRW protocol due to its worldwide use in library sector. In analysis, we found that 7 of selected libraries are using KOHA ILS which is host of Z39.50 server. 1 library can produce MARC record but not registered as Z39.50 client. Rest 2 libraries use MYSQL/PHP and ORACLE/ASP platforms respectively to develop the database of collection. In this procedure we suggested and showed some techniques to Data migration from different platforms to common platforms in practice. In conversion of data to MARC (.mrc) format we used a crosswalk tool- MARCedit. Which can convert data from xml format to MARC (.mrc) format. When all libraries have MARC file , interoperability scope almost get done. In this phase, recommendations were set for the libraries to join in a common interoperability model. These recommendations cover both the libraries that can export MARC format records directly and those that cannot but able to export MARCXML format records.

1.6 Limitations of the study:

The study has following limitations:

1. This study was carried out the to identify the feasibility of data exchange among university libraries. It does not cover other types of libraries.

2. The study was not conducted to develop a new interoperability protocol, rather than it was conducted to suggest an existing technique to make uniformity in metadata of bibliographic records.

3. This study only covers those university libraries that can produce MARC format record or MARCXML format record. It does not cover other university libraries that developed their database using other metadata schemes.

4. The study was not carried out for developing Z39.50/SRW client or server among university libraries. The study was designed supposing that all participating libraries have Z39.50 client/server access.

5. The study only describes technical feasibility. It does not focus on the intension of the library authorities whether they will share resource or not. The study was designed supposing that all participating libraries have intension to share their bibliographic resources.

Chapter 2

Literature Review

Chapter 2
Literature Review

2.1 Literature Review:

The review of literature is an essential component of any research investigation, which gives necessary input to the investigator to frame the research study on the chosen topic (Vinayagamoorathy, 2007). In this chapter an attempt has been made to review the literature on Interoperability, MARC 21, Z39.50, metadata transportation, data conversion and other related topics. In order to provide comprehensive conceptualization, the literature reviewed has been categorized under the following headings:

2.1.1 Interoperability:

The concept "Interoperability" in library field dramatically has been arisen due to the tremendous application of ICTs. Libraries worldwide using different platforms for development of their services. A standard platform should have interoperability capacity by design. Gates (2005) brilliantly describes the concept of interoperability in software perspective. His document describes what factors should be considered when one goes for developing a software with a view of interoperability. He also focuses how to design a software, which acts as basis for interoperability.

Now-a-days, Library automation is the buzz word in the field of librarianship. An automation software should have some basic characteristics that will support it to interoperate with other library automation software. Borgman(1996) wrote an article which is considered one of the prominent documents that describe basic factors should be kept in mind when taking an automation project in libraries. This document focuses what should library authority consider when planning library automation. It focuses on some rules to follow for interoperability approach in libraries.

Florence (2012), presented a paper which helps to learn how linked data can be used for chain interoperability among libraries dispersed throughout the world.

The document of Wusteman, J. (2006) helps to understand development and delivery of library services through Web. It describes how digital libraries keep combination and balance between self and other hosts when the library delivers web based library services.

2.1.2 Metadata Interoperability:

In exchange of bibliographic resources, metadata interoperability is a crucial issue. Johnston(2003) describes which factors should be followed when designing a metadata standard. He also focuses different types of metadata used as standard throughout the globe. His document also focuses what type of complexity may arise when metadata interoperability initiative is taken.

Chan(2006), excellently describes standardization in interoperability and metadata specification for interoperability in a pragmatic way to solve interoperability problem among different platforms.

Zeng(2001) wrote an article which describes the development of metadata interoperability in library field, problems faced in different metadata interoperability projects in the history and also focuses on metadata standard and its structure should be followed in interoperability project.

Coyle's(2000) document describes different Union catalogue projects initiated among different automated libraries. This document focuses problems, solution to the problem, complexity in different Virtual Union Catalogues through different approaches.

2.1.3 MARC:

Machine Readable Cataloguing(MARC) is worldwide used set of digital formats which act as standard for developing bibliographic databases. The document of Carvalho (2004) excellently describes the MARC. It focuses on Metadata of MARC in nice way. It focuses how to set MARC metadata in XML format, so that it becomes accurate and easy when data are exported or imported as XML format.

Husband (n.d.). wrote a document published by Library of Congress (LOC) which describes the MARC Standard followed by LOC in developing its collection database. It describes how interoperability complexity were managed during interoperability with other state libraries. It also focuses on origin and beginning history of MARC.

2.1.4 XML/ MARCXML:

Extensible Markup Language (XML) is a markup language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable. On the other hand MARCXML is also a XML type file that describes the different tags, indicator used by MARC. It is MARC customised XML type file.

Taylor and Dickmeiss(2005) presented a paper at *World Library and Information Congress: 71st IFLA General Conference and Council* which describes use of the XML in the development of library bibliographic database. It is the document about how Library of Congress did the excellent job in integrating MARC format database of its collection into Z39.50 framework using SRW/U protocol. This document describes the way of fruitfulness of the undertaken project by LC (Library of Congress) in interoperability field.

The document of Tenant (1999) helps library software, website developer to use XML in library perspectives. It helps library interoperability approach by providing proper guideline to use basic XML tag for indicating library database, meta information etc.

2.1.5 Z39.50 :

The research paper of NISO. (2003) published by LOC describes the Z39.50 protocol and its associated fields with nice illustration. It focuses how information can be retrieved from a focal server to various participating libraries.

Another document - Z39.50-Handbook. (2002) is all about Z39.50, which describes how to implement Z39.50 in library, how to design library OPAC for interoperability, how to participate in Z39.50 based interoperability consortia.

The research paper of Z39.50 Maintenance Agency. (2007) defines how to design and develop Library OPAC, how to map metadata, how to define MARC for OPAC, how to go towards interoperability approach with other automated or digital libraries using Z39.50 protocol.

2.1.6 Library automation, resource sharing and networking in Bangladesh:

Rezaul (2012) describes the web based library resource sharing in Bangladesh in his research, which focuses the present library cooperation and resource sharing using webpage in Bangladesh.

Mannan (1998) brilliantly describes about the facilities in library resource sharing and networking in Bangladesh and its prospects, fallbacks in his resource work.

Mannan & Suraiya (2000) excellently provide clear view of the academic library networking status, prospects, problems and recommendations in their research work.

Ahmed, S.M.Z., Munshi, M. N., & Ahmed, M. U. (1997) vividly describes the use of computer by libraries in different fields in Bangladesh.

2.2 Conclusion:

The review did not cover some aspects. The literature lacks from the knowledge about how to go for interoperability approach using those platforms that cannot produce MARC records. The review also lacks from knowledge about effective interoperability approach among automated libraries in Bangladesh. The review don't cover the literature about the conversion of other type of database that cannot produce MARCXML file. Though the review lacks of few aspects, it is found that the review focuses and covers enough our study objectives. By reviewing these literature, we got enough understanding about what is library interoperability, what characters approve a automation platform to be interoperable, what's the structure of MARC 21, how to interoperate using Z39.50, what the structure of a MARCXML, how to convert MARCXML into MARC, how to create Z39.50 client/server. Overall, the review provide guidelines about how to achieve our objectives.

Chapter 3

Theoretical Introduction to Interoperability, MARC 21 and Z39.50/SRW

Chapter 3

Theoretical Introduction to Interoperability, MARC 21 and Z39.50/SRW

3.1 Interoperability :

3.1.1 Introduction to Interoperability:

Interoperability is an essential feature for federated information architectures to work in heterogeneous settings and over time! However, use and understanding of the concept still are very heterogeneous: interoperability is conceived in an object-related or in a functional perspective, from a user's or an institutional perspective, in terms of multilingualism or of technical means and protocols. Moreover, interoperability is conceived on different abstraction levels: from the bit stream layer up to semantic interoperability.

Many attempts have been to define the concept of interoperability. A few examples are given below:

1. "The ability of multiple systems, using different hardware and software platforms, data structures, and interfaces, to exchange and share data" (NISO 2004)

2. "The ability of two or more systems or components to exchange information and use the exchanged information without special effort on either system" (ALCTS 2004)

3. "The compatibility of two or more systems such that they can exchange information and data and can use the exchanged information and data without any special manipulation" (Taylor 2004)

3.1.2 Interoperability Abstraction Levels :

Interoperability can be considered on very different abstraction levels, and the distinctions to be made in this respect cut across all the other matrix dimensions. Within a continuum ranging from a very concrete to a very abstract perspective it is possible to distinguish four layers as in the illustration below:

Abstract

Concrete
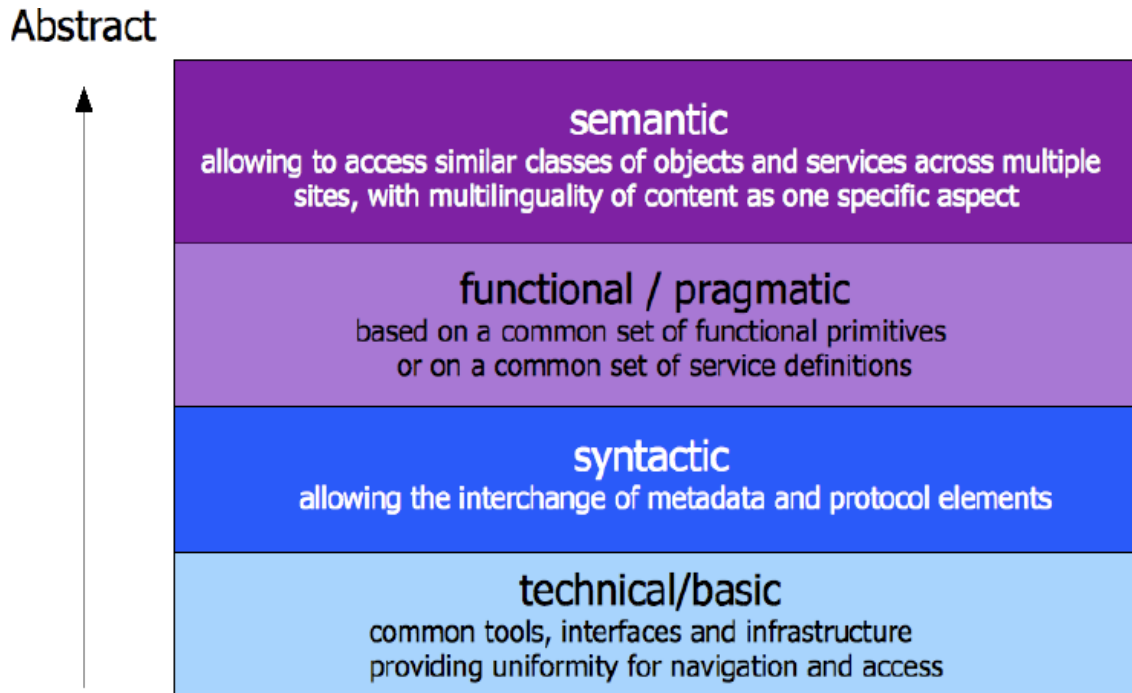
Figure-2. Abstraction level of Interoperability

While all levels are relevant for the interoperability issue it should be clear that technical and syntactic issues of interoperability probably are far better understood than the upper two layers and that therefore current discussions and research activities concentrate on the intersection of the pragmatic and the semantic layers.

3.1.3 Importance of Interoperability

Interoperability for digital libraries is more complex than for traditional libraries for several reasons.

1. First, there are myriad technical and engineering issues associated with connecting together networks, databases, and other computer-based systems; while the World-Wide Web is a good start at linking the world's information sources, it is neither comprehensive nor organized well enough to provide real library service.

2. Second, digital libraries will provide a greater array of services than do traditional libraries; for example, they already have sophisticated search engines, the ability to browse massive amounts of material quickly, and to reformat documents on-the-fly. Digital libraries can provide even greater services, such as negotiating rights to works (acting as proxies for human users), reformat queries into various natural languages, create composite works, and on and on.

3. Third, the types of information available in digital libraries, and the format of this information, will be in much greater variety than is typically the case for traditional libraries. Consider, for example, that the World-Wide Web distributes video (in many forms), audio (also in many forms), (marked up) text, computer software, and other forms of information. The trend is for this variety to become even greater.

4. Fourth, and most importantly, digital libraries will be composed of a large number of loosely connected components. This is because the demand for both services and information can be expected to grow so large that it is not possible for a single corporation, professional organization, or government to provide all that is necessary for a digital library; the problem is exacerbated when digital libraries are considered on an international scale. Additionally, a large percentage of the information and services that will be made available through digital libraries will be privately held intellectual property, and it is unlikely that control over this property will be yielded to third parties

3.2   MARC 21

3.2.1 Introduction to MARC 21

Machine Readable Cataloguing (MARC) 21, simply used as MARC 21 was designed to redefine the original MARC record format for the 21st century and to make it more accessible to the international community. MARC 21 has formats for the following five types of data: Bibliographic Format, Authority Format, Holdings Format, Community Format, and Classification Data Format. Currently MARC 21 has been implemented successfully by The British Library, the European Institutions and the major library institutions in the United States, and Canada.

MARC 21 is a result of the combination of the United States and Canadian MARC formats (USMARC and CAN/MARC). MARC21 is based on the ANSI standard Z39.2, which allows users of different software products to communicate with each other and to exchange data.

MARC 21 allows the use of two character sets, either MARC-8 or Unicode encoded as UTF-8. MARC-8 is based on ISO 2022 and allows the use of Hebrew, Cyrillic, Arabic, Greek, and East Asian scripts. MARC 21 in UTF-8 format allows all the languages supported by Unicode. The file extension a MARC file is .mrc/.marc. There are 1000 tags in MARC 21. Among these, many are unassigned. These tags ranges from 000-999, where the first tag 000 indicates the leader of an record.

3.2.2 Some fields of MARC 21:

Field Name	Tag No.
Leader	000
Library of Congress Control Number	010
International Standard Book Number	020
System Control Number	035
Source of Acquisition	037
Cataloguing Source	040
Dewey Decimal Classification Number	082
Local Call Numbers	090
Main Entry Personal Name	100
Title Statement	245
Edition Statement	250
Publication, Distribution, etc (Imprint)	260
Physical Description	300
Trade price	365
Series Statement	490
Bibliography, etc. Note	504.
Subject Added Entry-Topical Term	650
Location	852
Accession Number/System Serial No.	999

Table-1. Some tags of MARC 21

3.3 Z39. 50/SRW

3.3.1 Introduction to Z39. 50/SRW/SRU:

Z39.50/SRW is an international standard client–server, application layer communications protocol for searching and retrieving information from a database over a TCP/IP computer network. It is **Search & Retrieve Web Service(SRW)** based on Z39.50 protocol developed by Library of Congress. It is a computer-to-computer communications protocol designed to support searching and retrieval of information -- full text documents, bibliographic data, images, multimedia -- in a distributed network environment. (William, 1995). It is covered by ANSI/NISO standard Z39.50, and ISO standard 23950. The standard's maintenance agency is the Library of Congress. Z39.50 is widely used in library environments and is often incorporated into integrated library systems and personal bibliographic reference software. Interlibrary catalogue searches for interlibrary loan are often implemented with Z39.50 queries. The Contextual Query Language (formerly called the Common Query Language) is based on Z39.50 semantics.

3.3.2 Models of How Z39.50 is Used in Information Retrieval :

Figure-3. Z39.50 Model for Information Retrieval

Z39.50 Model of Resource Discovery
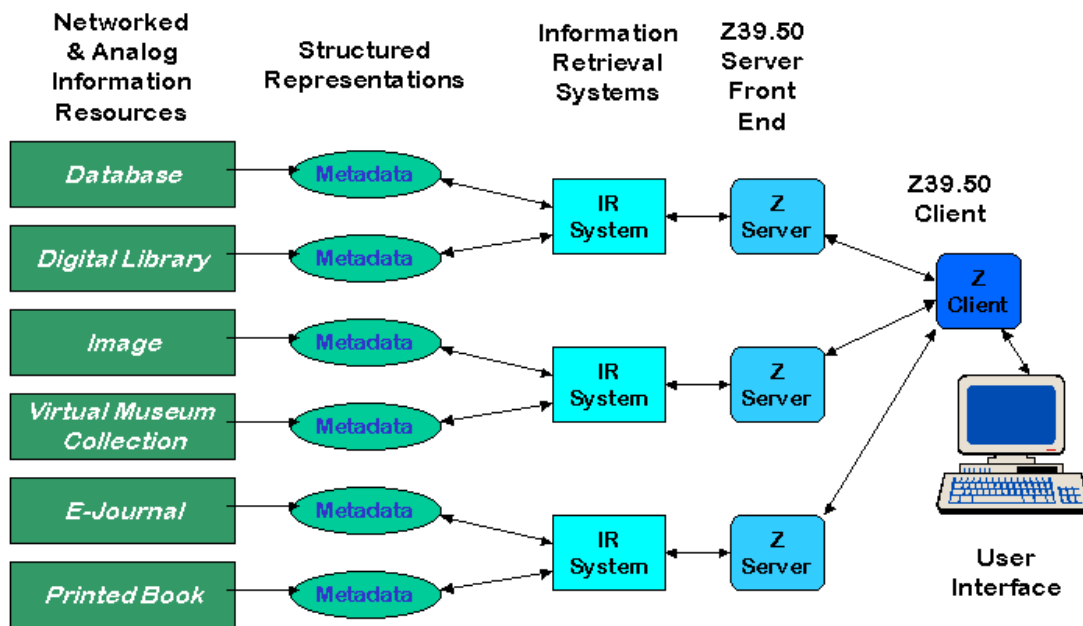
Figure-4. Z39.50 Model of resource discover

3.3.3 Importance of Z39.50:

It is a relatively simple, low-cost way to establish a multi-library catalogue, does not disrupt the existing environment and it can be implemented for a group of libraries even if they are using different brands of library automation systems.

Opportunities	Benefits
Enables a single interface for information retrieval -- choose a client carefully	Patrons will have easier access to information outside of the local library
Enables access to multiple, diverse databases, not just online library databases	Access is given to multiple databases through one interface
Supports simple and sophisticated searching	Access is given to multiple types of data through one interface
Allows flexible and customizable retrieval	Can easily create a "union" catalogue

Table-2. Opportunities and Benefits of Z39.50

Chapter 4

Selection of Sample Libraries and Survey

Chapter 4

Selection of Sample Libraries and Survey

4.1 Sample Selection:

There are good number of libraries that use ICTs in providing library services. 55% university libraries are using different library software for developing bibliographic collection. 17% university libraries are well automated. 80% university libraries have initiated automation program. 24.14% university libraries have initiated for full digitization process(Rezaul, 2012). The automation practice is more seen in private universities rather than public university libraries. It has become common practice to build OPAC for all prominent university libraries. Most of the libraries that have been automated follow MARC21 format in developing their OPAC. Considering the quality of OPAC and rank order in world ranking of Bangladeshi University(surveyed by 4 International Colleges & Universities organization, link: http://www.4icu.org/bd/), we selected 10 public and private libraries in Bangladesh, specifically in Dhaka, the capital city.

The following table focuses nature of libraries have selected for the survey.

Name of libraries	Public/ Private	Nature of the university	World Ranking of the university
University of Dhaka Library	Public	Miscellaneous	2
Bangladesh University of Engineering and Technology (BUET) library	Public	Engineering	3
Daffodil Int. University(DIU) Library	Private	Miscellaneous	5
North South University(NSU) Library	Private	Miscellaneous	8
East West University(EWU) Library	Private	Miscellaneous	12
Independent University of Bangladesh (IUB) Library	Private	Miscellaneous	15
BRAC University Library	Private	Miscellaneous	16
Military Institute of Science and Technology(MIST) Library	Semi Public	Engineering	N/A
Green University Library	Private	Miscellaneous	61
Bangabandhu Sheikh Mujib Medical University (BSSMU) Library	Public	Medical	75

Table -3. Sample libraries and their nature

4.2 Preparation of survey questionnaire:

Based on the socio-cultural influences and use of ICTs in university libraries in Bangladesh, a questionnaire was prepared to survey these libraries which is appended at the end of the paper. This questionnaire focuses different aspects of the library, i.e.- basic information, tradition of automation, platform information of automation, database structure and schema information etc.

The following figure shows the nature and pattern questions selected for questionnaire:

Questions type	Amount of questions	Ratio to the total questions	Effectiveness ratio to the study
Basic information	3	12%	10%
Basics of automation practice	8	30.5%	20%
Information about Metadata	6	23%	20%
Technical information including Database, Server, Script Language, Data exchange	8	30.5%%	40%
Suggestion	1	4%	10%
Total	26	100%	100%

Table -4. Question pattern and effectiveness in Questionnaire

4.2 Conducting Survey:

After preparing Survey Questionnaire, the selected libraries were visited to gather data for achieving our study objectives. Successful survey of all university libraries took almost 1 month. In some cases, library authority could not provide all information required by questionnaire. In those cases, some computer software were used to gather those missing information. After getting all information from all selected libraries, we approached to data analysis and findings phase.

Chapter 5

Findings

Chapter 5

Findings

5.1 Introduction to Sample Libraries:

This chapter describes the information found based on the survey, the analysis among those findings and provide a presentation of relational data among the libraries. The followings describe the information of sample libraries that found in the survey:-

5.1.1 Dhaka University Library

It was established in 1921 with the establishment of its mother organization- University of Dhaka. It has largest collection among Educational Institutions in Bangladesh. To provide better and faster user services in a convenient way, the Dhaka University Library has decided to automate its operations and services. In 1998, the library started its automation program named as Dhaka University Library Automation Project (DULAP), funded by UNDP and UGC (University Grants Commission). The Dhaka University Library has installed a proven library software GLAS (Graphical Library Automation System) equipped with a network server and a number of PCs distributed in a local area network (LAN) within the different sectors of the library and faculty buildings of the university. The system is being used for creating bibliographic databases, controlling acquisition, cataloguing and serials, effecting bar-coded circulation, reservation and recall systems, current awareness services (CAS), selective dissemination of Information (SDI) services and online literature searches of the national and international databases through CD-ROMs and also via internet (Alam,1996). For many reasons DULAP was fallen down. Now an integrated library system called DULIS is serving library . This software now integrates Acquisition section, processing section. Integrating Circulation section is under construction. It has more than 400000 Bibliographic collections in database. These Entries are made in following MARC21 Format.

Technical Specification of Dhaka University Library Integration System (DULIS) :

Server: Apache 2.2.3 Centos
Database: MySQL
Database Structure : Relational
Script Language: PHP
Total bibliographic Titles: About 400000
Cataloguing Language: AACR2
OPAC URL: http://library.du.ac.bd

MARC 21 Fields list that are followed in Data Entry:

No.	Filed Name	MARC 21 TAG
1.	Language:	377
2.	Author Name(s):	100
3.	Title:	245
4.	Volume:	362
5.	Edition:	250
6.	Place:	260
7.	Publisher Name:	260
8.	Year:	260
9.	Collation:	300
10.	Series:	440
11.	Notes:	500
12.	ISBN:	020
13.	Class No.:	090
14.	Location:	852
15.	Currency	310
16.	Price:	350
17.	Source:	040
18.	Type of Acquisition:	536
19.	Classifier:	386
20.	Primary Subject:	650
21.	Secondary Subject:	650
22.	Accession No.:	999

Table-5. MARC 21 fields followed by DULIS in OPAC
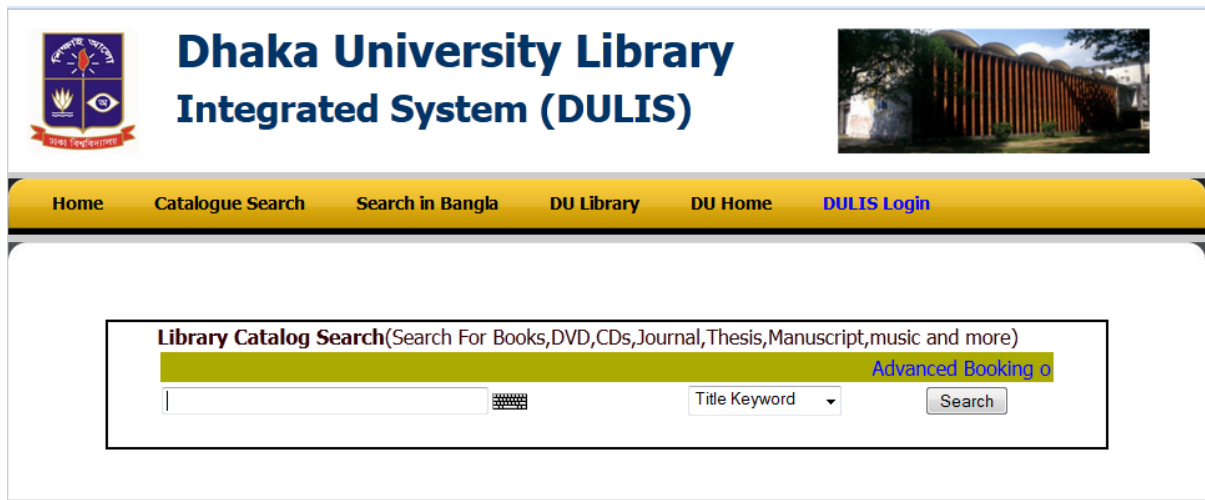
Figure-5. Homepage of DULIS website

Figrure-6. A retrieved record showing bibliographic information

5.1.2 Bangladesh University of Engineering and Technology (BUET) Library:

Bangladesh University of Engineering and Technology, abbreviated as BUET, is one of the most prestigious institutions for higher studies in the country. BUET use BUETLIB as their automation system. BUETLIB is locally- developed, server-based library software developed by the library's own programmer. The library collection consists of over 1,40,000 volumes of books, 17,849 volumes of Bound Journals and 218 current periodicals. Total no of records in BUETLIB is 78,556. Recently BUET has taken initiative for developing an integrated library system and repository system for its library.

Technical Specification of BUETLIB:

    Server: Microsoft Windows IIS v. 5
    Database: Oracle
    Database Structure : Relational
    Script Language: ASP
    Total bibliographic Titles: About 78,556
    Cataloguing Language: AACR2
    OPAC URL: http://www.buet.ac.bd/library

Figure-7. Homepage of BUETLIB website

Figure -8. Bibliographic details of a record of BUETLIB

5.1.3 North South University (NSU) Library:

North South University (NSU) Library grew over the years since 1992 and now has become one of the best university libraries in the country. This is the first fully automated university library in the country using Bi-lingual Library Management Software, developed by NSU Library, which supports MARC-21, web-based online lending and receiving, browsing databases of books, a-v materials, journals, newspapers and magazines, searching full-text online books and journals, creating institutional repositories, tracking circulation system, maintain RFID self check and book drop records, auto email alert services etc. It has around 49,500 books, reports and bound journals, over 40,000 online e-books, 36,000 online journals, 1,890 CD ROM books and databases, 226 DVDs and videos, 159 audio-cassettes and a good numbers of other resources. The library website can produce MARC format record of its collection.

Technical Specification:

Server: Apache 2.2.7
Database: MySQL
Database Structure : Relational
Script Language: Perl
Total Bibliographic Titles: About 49,000
Cataloguing Scheme: AACR2
Cataloguing format: MARC 21
URL of OPAC: *library.northsouth.edu/*
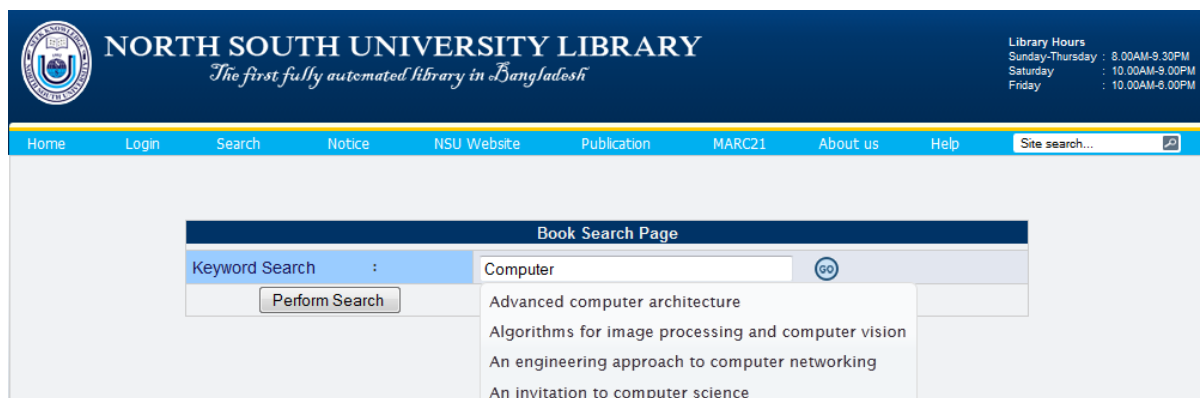
Figure- 9. Homepage of North South University Library Website
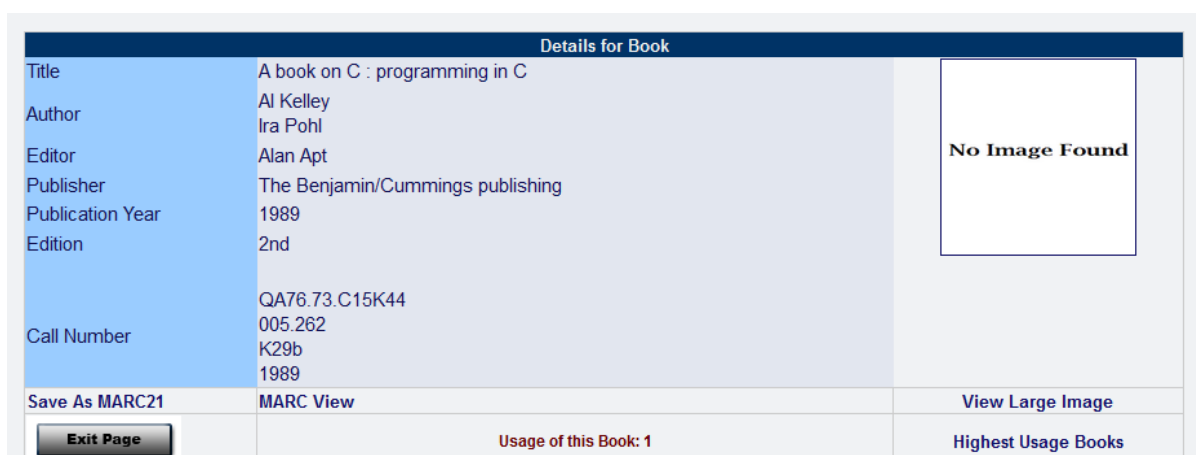
Figure -10. Bibliographic Details of a record of NSU library

Structure of MARC record that can be produced by NSU Library:

TAGS	Ind	Values
000		00536cam#a2200157u##4500
001		10833
003		BD-DhNSU
020	##	__|a 0805300600
050	04	__|a QA76.73.C15K44 005 __|b .262 K29b 1989
100	1#	__|a ,
245	03	__|a A book on C : __|b programming in C / __|c Al Kelley, Ira Pohl
250	##	__|a 2nd
260	##	__|a California __|b The Benjamin/Cummings publishing __|c 1989
300	##	__|a xv, 525 p. : __|b illus. ; __|c 23 cm.
490	0#	__|a The Benjamin/Cummings series in computing
650	#0	__|a C (Computer program language) Computer programming

Table– 6. MARC file tags with description of an entry of NSU

5.1.4 BRAC UNIVERSITY library:

Ayesha Abed Library(AAL) is the Central Library of BRAC University was inherited from BRAC in 2001. Then different technological application was applied. In BRAC University library, KOHA ILS was installed in 2010. It is practicing most of the modules of the KOHA. It has installed RFID system in its security. It has more than 45000 books in its collection.

Technical Specification:

> Server: Apache 2.2.6
> KOHA: V. 3.1
> Script Language: Perl
> Database: MySQL
> Total Bibliographic Titles: About 14,000
> Cataloguing Rules Language: AACR2
> URL of OPAC: http://*library.bracu.ac.bd*

MARC file tags with description of an entry

Tags	Indicator		Values
010			|a \\\99952538
020			|a 9843106105
040			|a DLC |c DLC |d BD-DhAAL
082	0	0	|a 307.3/364/0954922 |2 21
100	1		|a Ahsan Ullah, A. K. M.
245	1	0	|a History of Sylhet / |c Rajesh Kumar.
260			|a Dhaka : |b Bangladesh History Association, |c 1999.
300			|a 80 p. ; |b ill. ; |c 22 cm.
504			|a Includes bibliographical references (p. [70]-90).
541	1		|e 00013662
650		0	|a Poor |z Bangladesh |z Dhaka.
650		0	|a History |z Bangladesh |z Sylhet.
852	4		|a Ayesha Abed Library |j General shelf
999			|c 6758 |d 6758

Table -7. MARC file tags with description of an entry of BRACU library

5.1.5 Daffodil Int. University(DIU) Library:

It is one of the Leading university library that embraced the gift of Technology. It has been using KOHA ISL since 2011. It is also trying to apply most of the modules of KOHA. It has more than 20000 Books and journals.

Technical specification DIU Library

> Server: Apache 2.2.16 (Debian)
> KOHA: V. 3.1
> Script Language: Perl
> Database: MySQL
> Cataloguing Language: AACR2
> Total Bibliographic Titles: More than 2500+
> URL of OPAC: http://koha.daffodilvarsity.edu.bd

MARC file tags with description of an entry

Tags	Indicator		Values
010			|a \\\99952538
020			|a 9843106105
040			|a DLC |c DLC |d BD-DhDIUL
082	0	0	|a 307.3/364/0954922 |2 21
100	1		|a Ahsan Ullah, A. K. M.
245	1	0	|a Poverty and migration : |b slums of Dhaka city : the realities / |c A.K.M. Ahsan Ullah, Abdar Rahman, Munira Murshed.
260			|a Dhaka : |b Association for Rural Development and Studies, |c 1999.
300			|a 80 p. ; |b ill. ; |c 22 cm.
650		0	|a Urban renewal |z Bangladesh |z Dhaka.
700	1		|a Rahman, Abdar.
852	4		|a Daffodil University Library |j General shelf
999			|c 6758 |d 6758

Table -8. MARC file tags with description of an entry of DIU library

5.1.6 Green University Library:

Green University is one of the growing University which was established in 2003. It is now practicing application of ICTs in its library. It started its library automation in 2012. Now it has 1300 books and 100 journals physically. It installed KOHA ILS in 2013.

Technical Specification:

> Server: Apache 2.2.16 (Debian)
> KOHA: V. 3.100100
> Script Language: Perl
> Database: MySQL
> Total Bibliographic Titles: About 1000
> Cataloguing Language: AACR2
> URL of OPAC: http://library.green.edu.bd

MARC file tags with description of an entry:

000			01016nam a2200265 a 4500
008			1200708s2004 bg a 000 0aeng
020			_a9840801791
040			_aDLC _cDLC _dBD-DhGREEN
082	0	0	_a954.9205/1 _221
100	1		_aHuq, Farida.
245	1	0	_aJourney through 1971 : _bmy story / _cby Farida Huq.
260			_aDhaka : _bAcademic Press and Publishers Limited, _c2004.
300			_axii, 358 p. : _bill. ; _c23 cm.
650		0	_aAuthors, Bangladeshi _y20th century _vBiography.
852	1		_aGreen University Library _cGeneral shelf.
999			_c12 _d12

Table -9. MARC file tags with description of an entry of Green University library

5.1.7 East West University Library:

East west University is one of the oldest university in Bangladesh. It was established in 1996. It has been applying various ICTs in its library, i.e- KOHA ILS, VU find, DSpace etc. It has been installed KOHA ILS in 2010. Before that EW Library was using East West Library MIS, a good ILS. KOHA officially launched in 2011. It has more than 25000 books and journals physically.

Technical Specification:

    Server: Apache 2.2.16 (Debian)
    KOHA: V. 3.1204000
    Script Language: Perl
    Database: MySQL
    Total Bibliographic Titles: About 7300
    Cataloguing Language: AACR2
    URL of OPAC: http://opac.ewubd.edu/cgi-bin/koha/

MARC21 Entry list with an example:

000			00892nam a2200253Ia 4500
001			3077
003			EWU MFN
008			110604s9999 xx 000 0 und d
020			_a0195208900
040			_aBD-DhEWU
041			_aENG
082			_a330.9 17 24 _bWAS 1993
110			_aThe World Bank,,
245	1	0	_aWorld development report 1993 : _binvesting in health
260			_aWashington DC : _bOxford University Press, _c1993
300			_axii, 328 : _bill ;
504			_aIncludes bibliographies
653		1	_aEconomics
653		1	_aUnderdeveloped areas Economic development
655			_aPeriodicals

Table -10. MARC file tags with description of an entry of EWU Library

5.1.8 Bangabandhu Sheikh Mujib Medical University (BSMMU) Library:

BSMMU has a well equipped modern academic library known as Central Library. It was established in 1998. Bangabandhu Sheikh Mujib Medical University (BSMMU) has a modern electronic library known as Digital Library. It has installed KOHA ILS in 2011.

Technical Specification:

> Server: Apache 2.2.16 (Debian)
> KOHA: V. 3.0206000
> Script Language: Perl
> Database: MySQL
> Total Bibliographic Titles: About 12000
> Cataloguing Language: AACR2
> URL of OPAC: http://103.28.122.68/cgi-bin/koha

MARC21 Entry list with an example:

Tags	Indicator		Values
010			|a \\\99952538
020			|a 9843106105
040			|a DLC |c DLC |d BD-DhBSMMU
082	0	0	|a 307.3/364/0954922 |2 21
100	1		|a Molla, Harun
245	1	0	|a Dhaka : |b : a polluted city
260			|a Dhaka : |b Association for Rural Development and Studies, |c 1999.
300			|a 80 p. ; |b ill. ; |c 22 cm.
650		0	|a Poor |z Bangladesh |z Dhaka.
710	2		|a Association for Rural Development and Studies (Dhaka, Bangladesh)
852	4		|a BSSMU library |j General shelf
999			|c 6758 |d 6758

Table -11. MARC file tags with description of an entry of BSSMU library

5.1.9 Independent University of Bangladesh(IUB) Library :

Independent University of Bangladesh (IUB), is one of the leading University in Bangladesh. The University launched its library from its inception, i.e., 1993. The IUB Library in Dhaka holds over twenty five thousands (25,000) volumes which include books, back issues journals, cassettes and CD-ROMs.

Technical Specification:

> Server: Apache 2.2.16 (Debian)
> KOHA: v. 3.100100
> Script Language: Perl
> Database: MySQL
> Total Bibliographic Titles: About 14000
> Cataloguing Language: AACR2
> URL of OPAC: http://opac.iub.edu.bd/cgi-bin/koha/opac-search.pl

MARC21 Entry with an example:

000			00873nam a2200241 a 4500
008			110328s2004 bg a g 000 0 eng d
020			_a9840801899
040			_aBD-DhIUB _cBD-DhIUB
082	0	4	_a297.95492 _219
100	1		_aManzur-I-Khuda, Khaleda
245	0	0	_aIslam : _bthe formative background of Bangladesh / _cKhaleda Manzur-I-Khuda
250			_a1st ed.
260			_aDhaka : _bAcademic Press and Publsihers Library, _c2004.
300			_aix, 86p. : _billus ; _c22cm
650	1	7	_aIslam _2Spines
651		4	_aBangladesh
852	4		_aIUB Library _jGeneral Shelf

Table -12. MARC file tags with description of an entry of IUB library

5.1.10 Military Institute of Science and Technology (MIST) Library

Military Institute of Science and Technology (MIST), the pioneer Technical Institutes of Armed Forces, started its journey from 19 April 1998. It has more than 15000 Books and journals in its collection. It has launched KOHA ILS in 2013 and in 2013 it has launched DSpace for online repository management.

Technical Specification:

> Server: Apache 2.2.16 (Debian)
> KOHA: v. 3.100100
> Script Language: Perl
> Database: MySQL
> Tables: 154
> Total Bibliographic Titles: About 3000
> Cataloguing Language: AACR2
> URL of OPAC: http://203.112.75.133/main

MARC21 Entry with an example:

LEADER	01086nam a22002657a 4500
001	14180
003	MIST
005	20130921114923.0
008	130827s2002 bg a 00| 0 eng d
020	|a 9848230025
040	|a BD-DhMIS |c BD-DhMIS
082	|2 21 |a 627.4
100	|a Ali, M. Ashraf
245	|a Engineering concerns of flood : |b 1998 perspective / |c M. Ashraf Ali, Salek M. Seraj and Sohrabuddin Ahmad
260	|a Dhaka : |b Bangladesh university of Engineering and Technology, |c 2002
300	|a vi, 380 p. : |b ill. ; |c 24 cm.
504	|a Includes bibliographical references.
650	|a Floods -- Bangladesh -- Dhaka.
700	|a Seraj, Salek M.
700	|a Sohrabuddin, Ahmad
942	|2 ddc |c TEXT

Table -13. MARC file tags with description of an entry of MIST library

From the above information of the selected libraries, it is found that among the sample libraries , 7 libraries use KOHA ILS and other libraries use their own developed system for developing their bibliographic database. The following table shows the information about the platform, metadata used by the libraries and also the capacity to host using Z39.50 protocol.

Library Name	System Used	MARC 21	Z39.50 appliance
University of Dhaka Library	PHP/MYSQL	YES	Non direct. Requires: Data conversion and Z39.50 Client registration
BRAC University Library	KOHA	YES	DIRECET
DIU Library	KOHA	YES	DIRECT
NSU Library	PHP/MySQL		Non direct. Requires: Z39.50 Client registration
BUET Library	ASP/Oracle	YES	Non direct. Requires: Data conversion and Z39.50 Client registration
EWU Library	KOHA	YES	DIRECT
BSSMU Library	KOHA	YES	DIRECT
Green University Library	KOHA	YES	Direct
MIST Library	KOHA	YES	Direct
IUB Library	KOHA	YES	DIRECT

Table-14: Automation platform for OPAC in Sample libraries

5.2 Database Analysis

We see that 7 of the 10 selected university libraries are using KOHA ILS as it is open source and free to use, update and modify. KOHA is an Integrated Library System with a full range of features including, MARC based cataloguing, Union Catalogue facility, customizable search, circulation, cataloguing module with integrated Z39.50 client, and a simple acquisitions system for the smaller library. To understand the database of KOHA ILS, it is very essential to analysis the table structure, indexes and relationship.

5.2.1 Database of KOHA using Libraries :

 List of tables in KOHA:

There are 156 tables in KOHA v. 3.1. These tables have 1444 columns or fields. The following table, the **Table** column represents table name, **Children** column represents child table(s) associated with concerned table, **Parents** column represents how much times the concerned table become the child of other parents table, the **Rows** column represents the entry amount.

Table	Children	Parents	Columns	Rows
accountlines		2	16	0
accountoffsets		1	5	0
action_logs			7	0
auth_subfield_structure			16	0
auth_tag_structure		1	7	0
auth_types	1		4	0
authorised_values	1		6	0
authorised_values_branches		2	2	0
biblio	10		12	0
biblio_framework			2	0
biblioimages		1	5	0
biblioitems	1	1	34	0
borrower_attribute_types	2		11	0
borrower_attribute_types_branches		2	2	0
borrower_attributes		2	4	0

Table-15 : Some selected tables with structure of KOHA ILS v. 3.1

Table Structure of KOHA ILS :

It is not necessary to describe all tables to analysis the KOHA, but it is necessary to know the table structure of KOHA. Followings are two tables with their structure in detail.

Table name: – *biblioitems*
KOHA version 3.1
Database Type: MySQL - 5.5.32-0   ubuntu0.13.04.1

Column	Type	Size	Nulls	Auto	Default	Children	Parents
biblioitemnumber	int	10		√		items	
biblionumber	int	10			0		biblio
volume	mediumtext	16777215	√		null		
number	mediumtext	16777215	√		null		
itemtype	varchar	10	√		null		
isbn	varchar	30	√		null		
issn	varchar	9	√		null		
ean	varchar	13	√		null		
publicationyear	text	65535	√		null		
publishercode	varchar	255	√		null		
volumedate	date	10	√		null		
volumedesc	text	65535	√		null		
collectiontitle	mediumtext	16777215	√		null		
collectionissn	text	65535	√		null		
collectionvolume	mediumtext	16777215	√		null		
editionstatement	text	65535	√		null		
editionresponsibility	text	65535	√		null		

illus	varchar	255	√		null		
pages	varchar	255	√		null		
notes	mediumtext	16777215	√		null		
size	varchar	255	√		null		
place	varchar	255	√		null		
lccn	varchar	25	√		null		
marc	longblob	2147483647	√		null		
url	varchar	255	√		null		
cn_source	varchar	10	√		null		
cn_class	varchar	30	√		null		
cn_item	varchar	10	√		null		
cn_suffix	varchar	10	√		null		
cn_sort	varchar	30	√		null		
agerestriction	varchar	255	√		null		
totalissues	int	10	√		null		
marcxml	longtext	2147483647					

Table-16: Structure of *biblioitems* table in KOHA

Indexes:

Column(s)	Type	Sort
biblioitemnumber	Primary key	Asc
biblioitemnumber	Performance	Asc
biblionumber	Performance	Asc
isbn	Performance	Asc
issn	Performance	Asc
itemtype	Performance	Asc

Table-17: Indexes of *biblioitems* table in KOHA

Relation of different tables with *biblioitems :*

items	
itemnumber	
biblionumber	
biblioitemnumber	
barcode	
dateaccessioned	
booksellerid	
homebranch	
price	
replacementprice	
replacementpricedate	
datelastborrowed	
datelastseen	
stack	
notforloan	
damaged	
itemlost	
wthdrawn	
itemcallnumber	
coded_location_qualifier	
issues	
renewals	
reserves	
restricted	
itemnotes	
holdingbranch	
paidfor	
timestamp	
location	
permanent_location	
onloan	
cn_source	
cn_sort	
ccode	
materials	
uri	
itype	
more_subfields_xml	
enumchron	
copynumber	
stocknumber	
< 3	0 rows	8 >

biblioitems	
biblioitemnumber	int[10]
biblionumber	int[10]
volume	mediumtext[16777215]
number	mediumtext[16777215]
itemtype	varchar[10]
isbn	varchar[30]
issn	varchar[9]
ean	varchar[13]
publicationyear	text[65535]
publishercode	varchar[255]
volumedate	date[10]
volumedesc	text[65535]
collectiontitle	mediumtext[16777215]
collectionissn	text[65535]
collectionvolume	mediumtext[16777215]
editionstatement	text[65535]
editionresponsibility	text[65535]
timestamp	timestamp[19]
illus	varchar[255]
pages	varchar[255]
notes	mediumtext[16777215]
size	varchar[255]
place	varchar[255]
lccn	varchar[25]
marc	longblob[2147483647]
url	varchar[255]
cn_source	varchar[10]
cn_class	varchar[30]
cn_item	varchar[10]
cn_suffix	varchar[10]
cn_sort	varchar[30]
agerestriction	varchar[255]
totalissues	int[10]
marcxml	longtext[2147483647]
< 1	0 rows	1 >

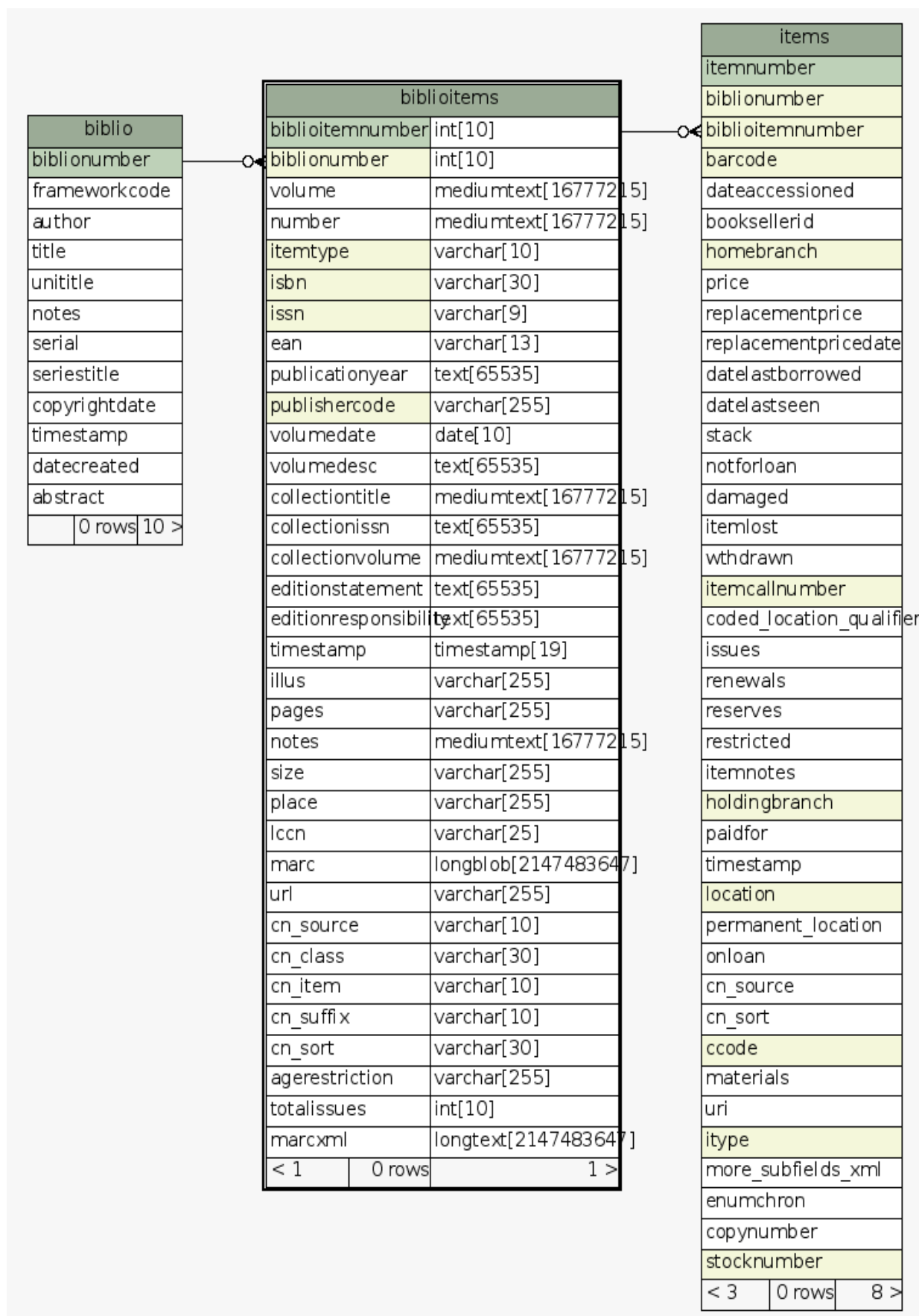| biblio	
biblionumber	
frameworkcode	
author	
title	
unititle	
notes	
serial	
seriestitle	
copyrightdate	
timestamp	
datecreated	
abstract	
	0 rows	10 >

Figure-11: relation of different tables with *biblioitems* table of KOHA

Table Structure of KOHA ILS :

Table name: – *biblio*
KOHA version 3.1
Database Type: MySQL - 5.5.32-0   ubuntu0.13.04.1

Column	Type	Size	Nulls	Auto	Default	Children	Parents
biblionumber	int	10		√		aqorders biblioimages biblioitems	
frameworkcode	varchar	4					
author	mediumtext	16777215	√		null		
title	mediumtext	16777215	√		null		
unititle	mediumtext	16777215	√		null		
notes	mediumtext	16777215	√		null		
serial	bit	0	√		null		
seriestitle	mediumtext	16777215	√		null		
copyrightdate	smallint	5	√		null		
datecreated	date	10					
abstract	mediumtext	16777215	√		null		

Table-18: Structure of *biblio* table in KOHA

Indexes:

Column(s)	Type	Sort
biblionumber	Primary key	Asc
biblionumber	Primary key	Asc

Table-19: Indexes of *biblio* table in KOHA

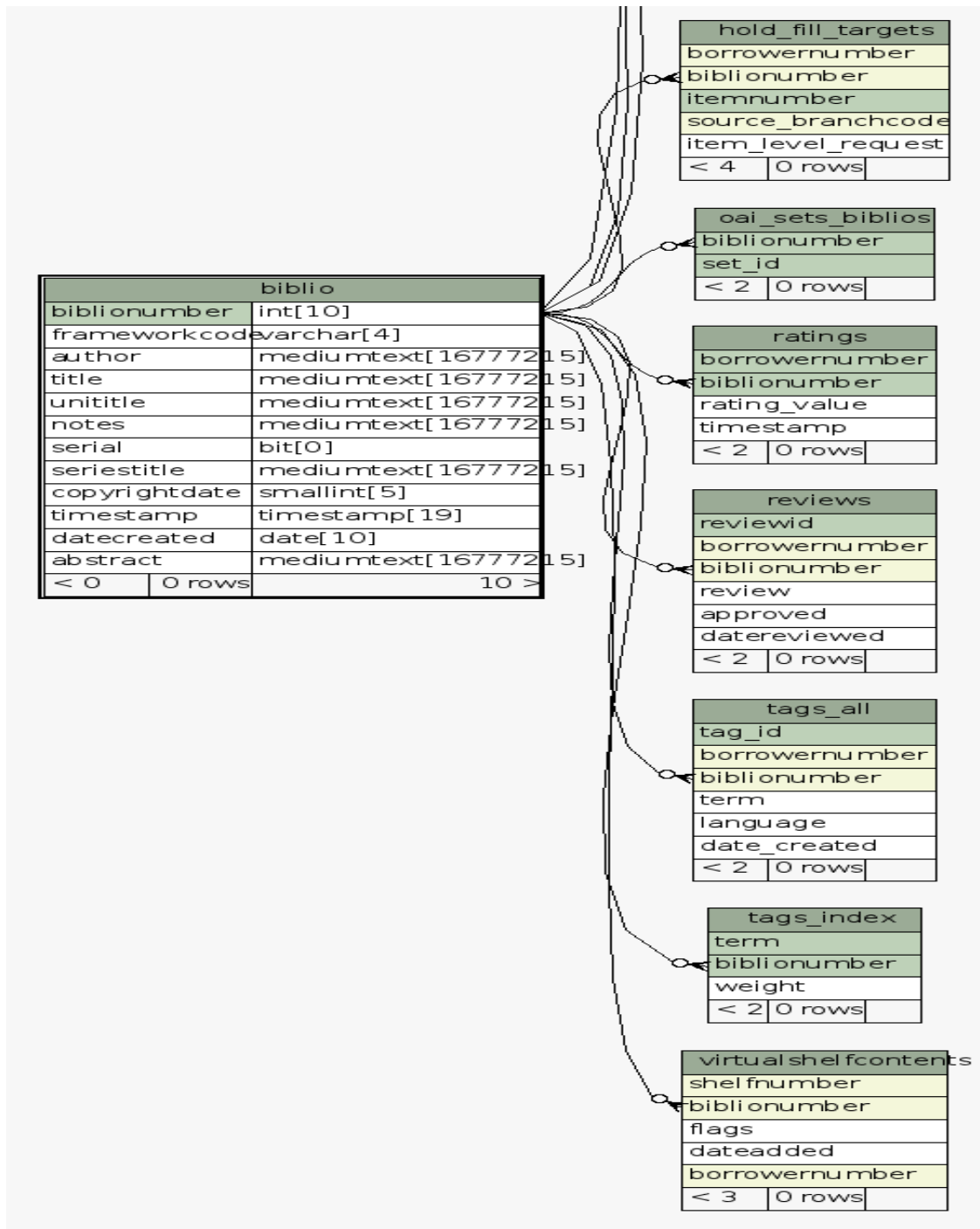Relationship of other tables with *biblio* :

Figure-12: relation of different tables with *biblio* table of KOHA

From the afore stated tables (Table -16 and Table-18) , it is shown that there are same types of fields in each table schema. They are-:

1	3	4	5	6	7	8	9
Column	Type	Size	Nulls	Auto	Default	Children	Parent

Structure of MARCXML file produced by KOHA ILS:

Now, let us look at the MARCXML file structure that is produced by KOHA for Z39.50 protocol. Following figure shows an example of a MARCXML file structure:

```xml
<?xml version="1.0" encoding="UTF-8"?>
 <record
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://www.loc.gov/MARC21/slim
 http://www.loc.gov/standards/marcxml/schema/MARC21slim.xsd"
    xmlns="http://www.loc.gov/MARC21/slim">
 <leader>  </leader>
 <controlfield tag="003">  </controlfield>
 <controlfield tag="005"> </controlfield>
 <controlfield tag="008"> </controlfield>

 <datafield tag="020" ind1=" " ind2=" ">
    <subfield code="a"> </subfield>
 </datafield>

 <datafield tag="040" ind1=" " ind2=" ">
  <subfield code="c"> </subfield>
 </datafield>

 <datafield tag="082" ind1=" " ind2=" ">
  <subfield code="a"></subfield>
  <subfield code="b"> </subfield>
 </datafield>

 <datafield tag="100" ind1="1" ind2=" ">
  <subfield code="a">  </subfield>
  <subfield code="9"> </subfield>
 </datafield>
```

```
<datafield tag="245" ind1=" " ind2=" ">
  <subfield code="a">  </subfield>
</datafield>

<datafield tag="250" ind1=" " ind2=" ">
  <subfield code="a"> </subfield>
</datafield>

<datafield tag="260" ind1=" " ind2=" ">
  <subfield code="c"> </subfield>
  <subfield code="b">  </subfield>
  <subfield code="a"> </subfield>
</datafield>

<datafield tag="300" ind1=" " ind2=" ">
  <subfield code="a"> </subfield>
</datafield>

<datafield tag="650" ind1=" " ind2=" ">
  <subfield code="a">  </subfield>
  <subfield code="9"> </subfield>
</datafield>

<datafield tag="942" ind1=" " ind2=" ">
  <subfield code="2"> </subfield>
  <subfield code="c"> </subfield>
</datafield>

<datafield tag="999" ind1=" " ind2=" ">
  <subfield code="c"></subfield>
  <subfield code="d"></subfield>
</datafield>
</record>
```

Figure 13- : Structure of a MARCXML file in KOHA

From the afore stated structure it is very clear that KOHA can produce .mrc file properly for interoperability in Z39.50. The selected 7 Libraries use KOHA. That's why these libraries can produce .mrc file and their KOHA ILS is by default a Z39.50 Host. So, these libraries can make a strong interoperability action using their existing KOHA ILS.

5.2.3 Database Analysis of the libraries that don't use KOHA ILS:

In the survey it was found that three libraries- University of Dhaka Library, BUET Library and North South University Library using their own developed system for OPAC. Among these three, North South University Library using an Integrated system which can produce .mrc file to harvest its collection to Z39.50.

University of Dhaka Library and BUET library use their own ILS respectively known as-DULIS and BUETLIB which cannot produce .mrc file. There is no system to produce XML file also. But they follow the fields of MARC 21 in developing bibliographic information of an item in its OPAC. Following are examples of two libraries which show how they follow MARC 21 fields in data entry of an item.

Use of MARC 21 in OPAC of DU library:

Figure-14: MARC fields in OPAC of DULIS

Use of MARC 21 in OPAC of BUET library :

BUETLIB

About   Home

Book Detail	MARC21 TAG
Do-it -yourself PC book: an illustrated guide to upgrading and repairing your comput	245
Author(s): Kyle Macrae	100
Imprint: McGraw-Hill, Osborne, **2001** Edition: 1st	260
Pagination: 159p.	300
Subject(s): Microcomputers	650
Keywords: computing, monitor, processor	
Department(s): Department of Computer Science & Engineering	850
ISBN: 0-07-213377-5 **Call no.** 004.16/MAC/2001	090
Available at: Circulation (Show all copies)	852
	020

Figure-15: MARC fields in OPAC of BUETLIB

From the above figures, it is clear that both libraries follow MARC 21 field entry in developing their bibliographic record. Both of them follow AACR2 as cataloguing rules. But there are no system to export these data as .mrc data file. So, there is no scope to host the bibliographic record in 39.50 Engine. To achieve interoperability of these libraries, we have to convert the existing bibliographic database to MARC Database in order to join in interoperability using Z39.50 protocol. This procedure is presented in the chapter 6 –" Development of Interoperability Model and Recommendations".

Chapter 6

Development of Interoperability Model and Recommendations

Chapter 6

Development of Interoperability Model and Recommendations

6.1 Introduction to Interoperability model:

This chapter will develop an interoperability model for all the selected libraries. All these libraries will be interconnected and will exchange data using Z39.50 protocol. The libraries that use KOHA ILS can directly join in this network, but other libraries have to produce Standard MARC records and to register as Z39.50 client. Data Conversion Model describes how these libraries would be able to convert data into MARC and can be connected in interoperability model using Z39.50 protocol.

The following figure shows the proposed interoperability model of how all libraries can be part of interoperability:
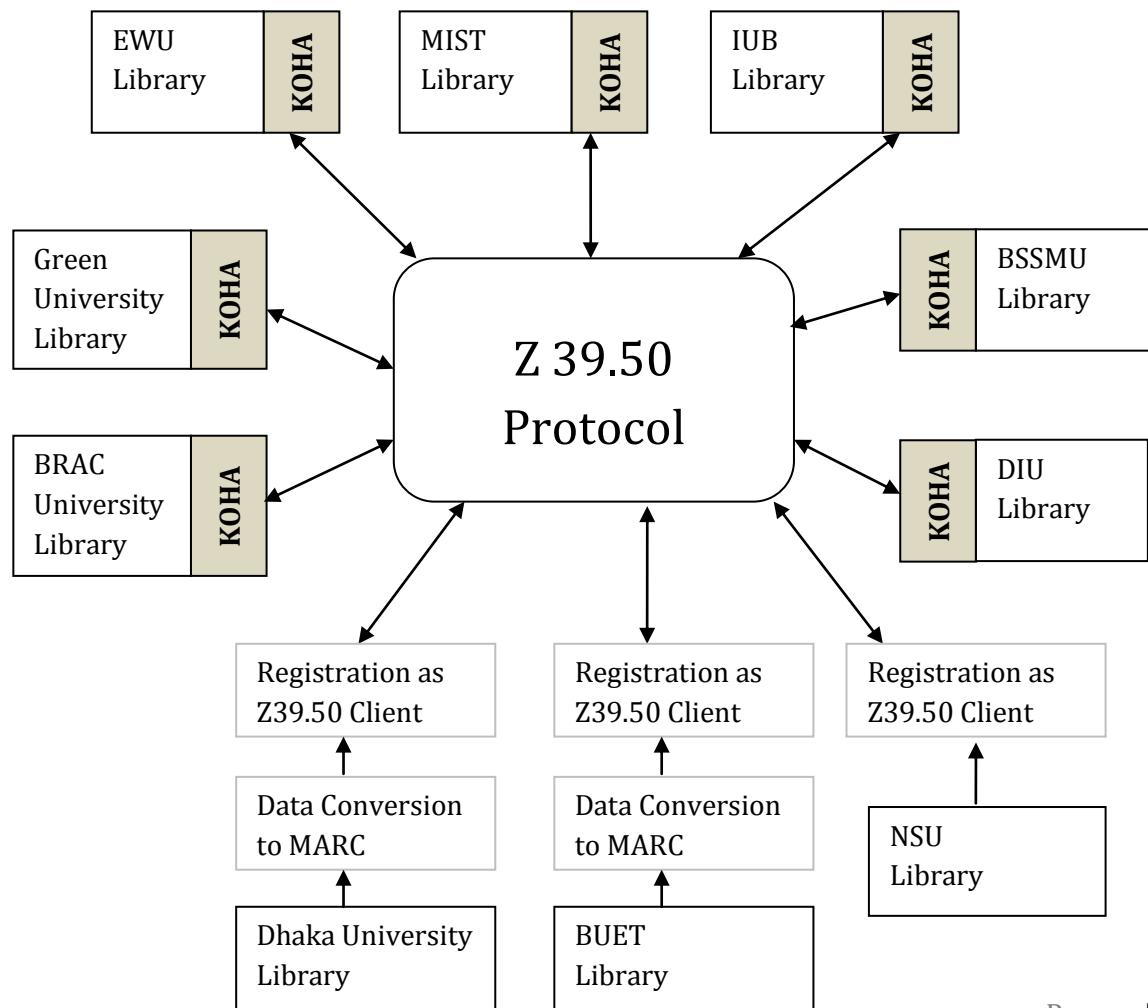
Figure-16: Proposed Interoperability Model

Model Description :

Focal Protocol:

In the model, Z39.50 protocol is the focal protocol through which libraries will exchange their bibliographic resources. Using this protocol, libraries can also be connected to those libraries throughout the globe which are also connected using the Z39.50 protocol.

KOHA using libraries:

KOHA ILS is, by default, a Z39.50 client. So, all the libraries using KOHA, i.e.-EWU library, MIST library, Green university Library, BRAC university library, BSSMU library, DIU library, IUB library are already connected to Z39.50. These libraries can exchange their bibliographic resources directly.

Libraries using other platforms:

Dhaka university libraries and BUET Library:

In the **Chapter 6 – Findings**, it was found that Dhaka university library and BUET library follow MARC 21 in development of OPAC. To be connected in interoperability model, these libraries have to convert their database into MARC database. In After that these libraries have to register as Z39.50 client.

NSU Library:

NSU library can produce MARC record. Therefore, NSU library can be connected in interoperability model by registering as Z39.50 client.

6.2 Data Conversion Model:

Dhaka university library, BUET library requires data conversion of existing database into MARC in order to be part of Interoperability model. There are many methods for converting data into MARC. We will use MarcEdit tool for conversion as it is most popular GUI tool. Following figure shows how the data can be converted into MARC record:

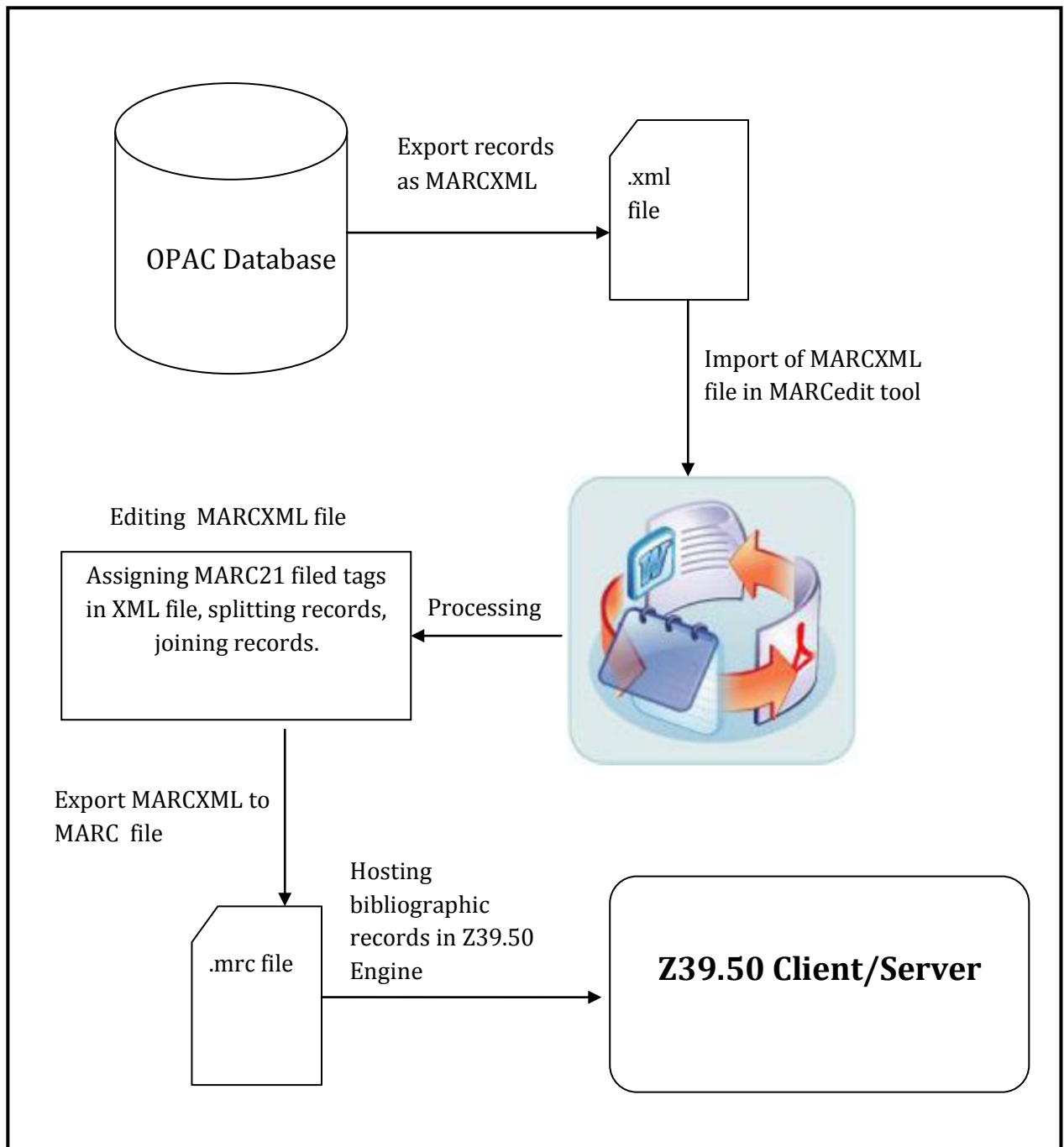The following figure shows the recommended model of interoperability:

Figure-17. Recommended Data Conversion Model

This model consists of three functional steps. Step by step procedures of this recommended model are described below:

1. Exporting database as MARCXML:

MARCXML file type actually a XML file type, where XML fields are designed according to MARC tag. Following figure describes the MARCXML file structure

```
1.  <?xml version = "1.0" encoding = "UTF-8"?>

2.  <collection xmlns=http://www.loc.gov/MARC21/slim >

3.  <record >

            i.  <leader>    nam  2200457 a 4500</leader>

           ii.  <datafield tag="245" ind1="0" ind2="4">

                    <subfield code="a">The bonny scot</subfield>

                    <subfield code="b">:  the yielding lass.</subfield>

          iii.  </datafield>

4.  </record>

5.  </collection>
```

Figure – 18. Structure of a MARCXML file

Analysis of the figure:

The first line defines the file type as XML. The second line describes collection style as http://www.loc.gov/MARC21/slim. The third line indicates the starting of a record. The sub tag <leader> indicates the leader tag. The <datafield> tag indicates the MARC tag 245, that is Title of the collection. The <subfield code="a">: tag describes the Main heading of the title, whereas, the <subfield code="b"> indicates the sub heading of the title. The </datafield> indicates the ending of a filed. The </record> tag indicates the end of the record and the </collection> tag indicates the end of the collection.

2. Editing the MARCXML file in MARCEdit:

After producing, the MARCXML file should be opened with MARCEdit tool, a free tool developed by Terry Resse. Present day, it is available with version no. 5.9.5076. The MarcEdit has been designed to support the MARC format, regardless of flavour (eg. MARC21, UNIMARC, etc). The MarcEdit has been designed with an XML API to provide support for other XML schemas. The software is available in http://www.marcedit.reeset.net for free.

Following figures shows how XML file will be edited in MARCEdit :
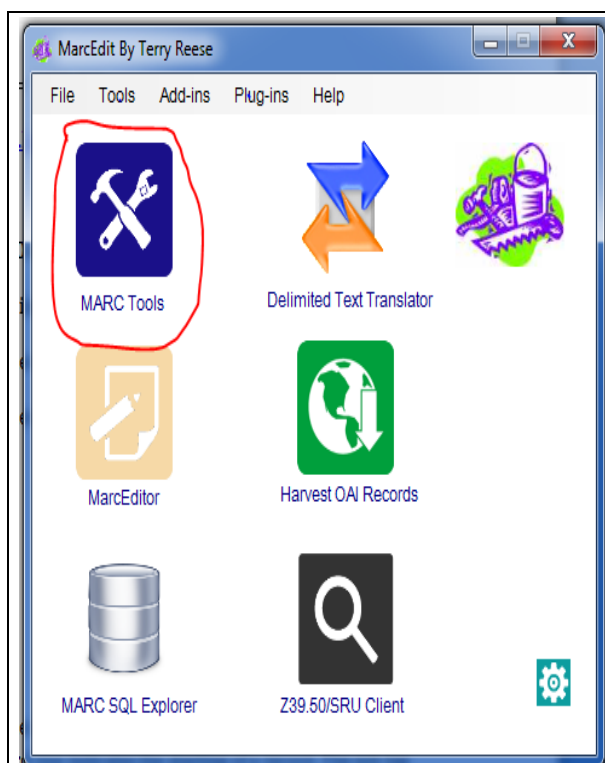
Figure- 19: MarcEdit interface	Figrue-20: MARC Tools option in MarcEdit
After opening the MarcEdit tool, MARC tools should be clicked. Then MARC tools window will be opened.	1. In the **Input File**: field, the XML file should be chosen, that was previously developed. 2. In the **Output File**: field, the desired MARC file name and directory should be selected. 3. **Functions** : MARC21XML =>MARC and **Translate to MARC-8** should be selected. 4. Finally, **Execute** button should be clicked to run the program. Thus we get MARC file of a record.
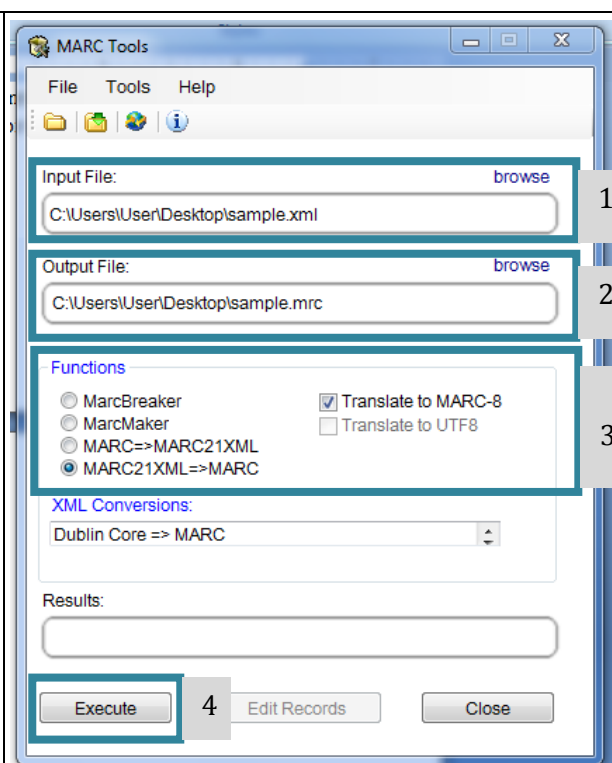
Table-20: Procedure of converting MARCXML(.xml) into MARC (.mrc)

3. Hosting database using Z 39.50 Protocol:

After getting MARC records, the MARC database can be hosted using Z39.50/SRU/SRW protocol. The library can be a Z39.50 client or can develop Z39.50 server. To develop Z39.50 clients and servers, libraries are suggested to use YAZ toolkit. YAZ has been considered as the leading toolkit for building Z39.50 clients and servers since its first release in 1995. During a decade and a half of active service, the YAZ toolkit has been battle-hardened in every conceivable type of employment, and grown in its support for even the more esoteric aspects of the Z39.50, SRU/SRW, and lately Solr protocols. The majority of library software vendors use the YAZ toolkit to implement the protocol support in their products, and many others routinely use the toolkit for interoperability testing, data conversion, etc.

YAZ is a programmers' toolkit supporting the development of Z39.50/SRW/SRU clients and servers. Z39.50-2003 (version 3) as well as SRU version 1.1 thru 2.0 are supported in both the client and server roles. The Solr web service is supported in the client role through the ZOOM API. For details about YAZ, browsing the link : http://www.indexdata.com/yaz can be helpful.

After developing Z39.50 client / server, libraries can join in worldwide library bibliographic database using Z39.50 protocol. They can even import collections of other libraries that are also Z39.50 client. Followings are some prominent library's gateway information to interoperate.

Library name	Library of Congress	British Library	University of Southern California
Address	z3950.loc.gov	Z3950cat.bl.uk	128.125.19.173
Port	7090	9909	2200
Database	VOYAGER	BLAC	UNICORN
Validation	None	None	None

Table -21: Connection information of some selected Z39.50 client libraries

6.3 Some guidelines for libraries to be participated in interoperability approach:

1. National Policy should be determined for defining standard library automation platforms, metadata scheme that should be followed in developing library databases.

2. Libraries are suggested to develop bibliographic database using an Integrated Library System (ILS) that can produce MARC record and can exchange bibliographic records using Z39.50 protocol. In this respect, KOHA ILS, Evergreen, Greenstone are suggested to use as they are, by default, well designed system and host of Z39.50.

3. The libraries willing to develop bibliographic database using their own developed platform should design the information structure that would follow the MARC rules and structure.

4. The libraries that already develop bibliographic database that don't support exporting database in MARC format, should use third party tool for converting database into MARC database. In this respect, MarcEdit tool is suggested to use as it is more easy and effective.

6.4 Conclusion:

It is evident that the modern information & communication technology (ICT) has changed the scenario of the availability of information resources. Library automaton has increased the use of information resources through the creation of database and information retrieval. The rapid growth of internet resources and digital collections has been accompanied by a proliferation of various automation platforms , each of which has been designed based on the requirements of particular user communities, intended users, types of materials, subject domains, project needs, etc. Problems are arisen when libraries want to interoperate bibliographic records developed using different platforms and schemes. For the exchange of bibliographic resources among these libraries, uniformity of metadata structure should be kept in mind. That automation platform should be selected or developed that can exchange its bibliographic records as different international metadata scheme require. Thus library gathers the capacity to be interoperable with different types interoperability consortia based on different types of metadata scheme. When the libraries' OPAC systems fail to produce certain type of record required by interoperability platform, they should use third party tools to convert their database to the required format. Therefore, the libraries using different platforms in developing bibliographic database can join in a common interoperability platform which will make a strong library co-operation and resource sharing.

References:

1. Ahmed, S.M.Z., Munshi, M. N., & Ahmed, M. U. (1997). Computerisation of libraries in Bangladesh. *Malaysian Journal of Library & Information Science ,* 2 (2), 37-43.

2. Borgman, C.L. (1996). Automation is the answer, but what is the question? Progress and prospects for Central and Eastern European libraries. *Journal of documentation,* 52(3), 252-92.

3. Chan, L.M. (2006). Metadata Interoperability and Standardization – A Study of Methodology Part I. *D-Lib Magazine,* 12(6), 201-204.

4. Coyle, K. (2000). The Virtual Union Catalog: a comparative study. *D-Lib Magazine,* 6(3), 30-37.

5. De Carvalho, J.R. et al. (2004). Meta-information about MARC: an XML framework for validation, explanation and help systems. *Library Hi Tech,* 22(2), 131-37.

6. Gates, B. (2005). *Building software that is interoperable by design.* Retrieved 12 11, 2013, from Microsoft: www.microsoft.com/mscorp/execmail/2005/02-03interoperability.mspx

7. Husband, C. W. (n.d.). *MARC Standards.* Retrieved 11 12, 2013, from Library of Congress: http://www.loc.gov/marc/bibliographic/mapping/MARC21-PREMIS.html

8. Islam, Shariful. (2013). Library Digitization in Bangladesh: A developing Country Perspective. *Research Journal of Library Sciences,* 1(1), 2-9.

9. Islam, Mirza Mohd. Rezaul. (2012). Present Status of Library Cooperation, Networking, and Resource Sharing in Bangladesh: Web-based Library Cooperation for Access to World-wide Information. *Library Philosophy and Practice, 784.* Retrieved 11 12, 2013, from: *Library Philosophy and Practice:* http://digitalcommons.unl.edu/libphilprac/784

10. Johnston, P. (2003). *Metadata and interoperability in a complex world.* Retrieved 12 November, 2013, from Ariadne : http://www.ariadne.ac.uk/issue37/dc-2003-rpt/

11. Mannan, S. M. (1997). Networking and resource sharing among the libraries in Bangladesh: present conditions and future prospect. (an unpublished Ph. D. dissertation). Dhaka: University of Dhaka.

12. Mannan, S. M. (1998). The availability of automation facilities for networking and resource sharing in Bangladesh. *Bangladesh Journal of Library and Information Science*, 1 (1).

13. Mannan, S. M. and Begum, Suraiya (2000). Bangladesh academic and special library network: a proposal. *The Dhaka Unviersity Studies*, 57(1).

14. NISO. (2003). *Information Retrieval (Z39.50): Application Service Definition and Protocol Specification*. Retrieved 11 12, 2013, from Library of Congress: http://www.loc.gov/z3950/agency/Z39-50-2003.pdf

15. OCLC (2002). *Z39.50 Handbook*. Retrieved 11 12, 2013, from OCLC: http://www.oclcpica.org/content/45/pdf/z3950_handbook_paper.pdf

16. Taylor, M. and Dickmeiss, A. (2005). Delivering MARC/XML records from the library of congress catalogue using the open protocols SRW/U and Z39.50. *World Library and Information Congress: 71st IFLA General Conference and Council,* Oslo.

17. Tenant, R. (1999), *XML in Libraries*. New York: Neal-Schuman.

18. University of Florence (2012). *Global interoperability and linked data in libraries*. Retrieved 12 11, 2013, from Linked Heritage: www.linkedheritage.org/linkeddataseminar/index.php?en/1/home

19. Wusteman, J. (2006). Realizing the potential of web services. *OCLC Systems & Services: International Digital Library Perspectives*, 22(1), 5-9.

20. Zeng, M.L. (2001). Supporting metadata interoperability: trends and issues. *Global digital library development in the new millennium*. Beijing: Tsinghua University, 405-412.

21. Z39.50 Maintenance Agency. (2007). *Bib-1 Attribute Set*. Retrieved 11 December, 2013, from Library of Congress: http://loc.gov/z3950/agency/defns/bib1.html

APPENDIX-1: COVER LETTER of Questionnaire

[It is purely for academic purpose]

Thesis Title: "Interoperability Among University Libraries

in Bangladesh: Data Exchange Feasibility"

Chief Librarian/Librarian/Head/Director

Dear Sir/Madam,
In partial fulfillment of the requirement of my M.A. studies at the department of Information Science and Library Management, University of Dhaka. I am conducting a study entitled "Interoperability Among University Libraries in Bangladesh: Data Exchange Feasibility".

The core objective of this research is to explore the data exchange feasibility among university libraries of Bangladesh. Other purposes includes the development of an interoperability model for all university libraries using different types of platforms in their library automation.

In order to collect the necessary information for my research work, I need to conduct a survey of university libraries in Bangladesh. Your response to the questionnaire is vital to the successful completion of my research.

I would be very grateful if you kindly spend your busy schedule to fill up this questionnaire.

I assure you that the information would be used for academic purposes following research ethics.

Thanking you very much in anticipation for your time and cooperation.

Yours sincerely,
Suzon Chandra Das
M.A (Session: 2011-12)
Exam roll: 3035
Department of Information Science and Library Management
University of Dhaka, Dhaka-1000

APPENDIX-2: Questionnaire

Questionnaire on

Interoperability Among University Libraries in Bangladesh : Data Exchange Feasibility

[Please give tick (√) mark on the relevant ones. Please mark as many boxes as apply]

1. Basic Information:

    a.   Name of your University Library :

        _____

    b.   Establishment Year of the Library: _____

    c.   Present Collection (Physical):

    Books: _____   Thesis: _____

    Journals : _____   Manuscripts : _____

    Others : _____

    d.   Pattern of your university library based on service:

        ☐ General   ☐ Technical ☐ Medical ☐ Agricultural

2. Technical Information:

    a. When automation program was first inaugurated in your library?

        : _____

    b. Which library sections are automated till now:

Fully	☐ Acquisition ☐ Processing ☐ Circulation ☐ Serial Control ☐ Cataloguing ☐ Administration ☐ Reference
Partially	☐ Acquisition ☐ Processing ☐ Circulation ☐ Serial Control ☐ Cataloguing ☐ Administration ☐ Reference

c. Which system do you use to automate your library:
☐ Integrated Library Software (ILS) or
☐ Single Alone Software (SAS)

d. The name of the first ILS or SAS in your library and the year it was installed : _____

e. What is the name of present ILS or SAS and the year it was installed: _____

f. What was the name of the last ILS or SAS in your library:

_____

g. How did you transfer data from previous ILS or SAR to present one: _____

_____

_____

h. The present ILS or SAS you use is Open source or proprietary:
☐ Open Source   ☐ Proprietary

i. Version of present ILS or SAS:_____

j. Scripting Language of present ILS or SAS with its version:
☐PHP ☐Perl ☐Ruby on Rail ☐Python ☐ASP
☐Others : _____
Version:_____

k.   Database system of Present ILS or SAS:
☐ ORACLE ☐ MYSQL ☐ PostGres ☐ Other: _____
Version:_____

l.   Running Server Software with version:

_____

m. Which MARC standard do you follow in OPAC?
☐ MARC21 ☐ USMARC ☐ UNIMARC
others:_____

n. In which format data can be exported from present

ILS or SAS: ☐ MARC ☐ MARCXML ☐ XML

Others: _____

o.   Which interoperability protocol your automation

platform support : ☐ Z39.50 ☐ Others : _____

p.   If you use Z39.50 then mention the Libraries that are used to
import data:
i.   _____
ii. _____
iii. _____
iv. _____

q. The present amount of Bibliographic records in the Database:

_____

r. Which Fields or tags do you fill in cataloguing
(if possible with an entry example):
i.   URL of the record:_____

Field Name	Tag	Indicator	Field	Subfield

3. Information on Cataloguing Rule

a. which cataloguing rule do you follow in cataloguing :
☐ AACR ☐ AACR2 ☐ LC or, Other:
_____

4. OPAC information:

a. URL of your library OPAC :_____
b. Availability of OPAC access: _____

5. Suggestions:

a.   What sort of problems and challenges do you think that may be encountered for the development of interoperability and data exchange consortia among university libraries in Bangladesh?

i.   _____

ii.   _____

iii.   _____

b.   Put forward your recommendation for improving the situation of Interoperability among university libraries in Bangladesh:

_____

_____

_____

_____

Thank you very much for your kind assistance in my research by providing the valuable information of your library. If you have any further query or information please feel free to contact with me.

Name of the Respondent:

Designation:

Signature & date: