A Comparative Study of Tools used in Building Open Source and Proprietary Integrated Library Systems

Light Mawumenyo Kwami [1], Joseph Kobina Panford [2], James Ben Hayfron-Acquah[3]

[1] *Department of Computer Science, KNUST, Kumasi, Ghana*

[1] `lkwami@ucc.edu.gh`

[2]*Department of Computer Science, KNUST, Kumasi, Ghana*

[2]`jpanford@yahoo.com`

[3]*Department of Computer Science, KNUST, Kumasi, Ghana*

[3]`jbha@yahoo.com`

Abstract—**Open source Integrated Library System (ILS) may be view by many as a comprehensive occurrence that have the potential of providing the library industry with substitute and aggressive way of doing business. Research done so far has tackled the history and business aspect of the open source library occurrence and only few have researched its technical aspect.**

This research explores the reason behind the poor level of adoption of open source LMSs in Ghana, and whether it is due to poor awareness about the concept or the technical inadequacies in the open source tools. The research was done in two major stages. The first stage involved conducting surveys to measure knowledge and attitude towards open source. The survey scrutinized three groups of participants involved in the library industry namely: Administrators, End users and IT specialists. The measurement of knowledge and attitude was done by forming a knowledge and attitude indicators. The author formed these indicators during the course of the study in order to give a quantifiable and picturesque indication of the results. The second stage involved conducting a comparative analysis between two proprietary ILS (Millennium and Aleph) and two open source ILS (Koha and NewGenLib).

The results of the research provide an insight to how the different groups of participants view open source and indicates the lack of knowledge about open source concepts and its expertise maybe a major reason behind the poor adoption of open source ILS in Ghanaian libraries. The results of the comparative analysis also show that open source ILS are technically equivalent to its proprietary counterparts.

Keywords: Open Source, ILS, LMS, Web Server, Database Server, Client terminal, MARC

I. INTRODUCTION

An integrated library system (ILS), which is also called a library management system (LMS), is an operational scheme planning for libraries. Use for tracking items a library own, materials that have been ordered, purchases made, bills that have been paid or to be paid, and materials have been borrowed by patron. An ILS is usually made-up of a database of tables, an interactive application, and two graphical user interfaces (for patrons and staff respectively). Many ILS's software function as detached programs called components or modules merged with an interface. Examples of modules might include acquisitions (ordering, receiving, and invoicing items), cataloguing (classifying and indexing items), circulation (charging and discharging of items), serials (tracing periodical items), the OPAC (public interface for End Users) ([1].

The ILS database assigns a unique ID to each patron and item in order to trace every activity [46]. Libraries use ILS's for ordering and acquiring, receiving and invoicing, cataloguing, circulating, tracking and shelving items. The University of Texas begun mechanizing their circulation module using the punch card system. The punch card system permitted for more effectual way of tracking of materials on loan, but other library service were far from being integrated. The change did not affect any other library tasks. The emergence of MARC standards in the 1960s and the advancement in computer technologies, begun the birth of library automation. Libraries commenced testing with computers and bibliographic services; taking advantage of new technology and MARC terminology moved into the marketplace. Improvements in computer storage and telecommunication resulted in advances in complete structures on microcomputers called an integrated library systems (ILS) ultimately materialized. It (systems) comprises of the required hardware and software, which permitted the link of crucial circulation, controls as well as overdue notifications [11]. As technology, advanced additional library responsibilities have been achieved through ILS as well. Tasks such as Purchase, classification, titles reservation and series checking.

The scope of Integrated Library Systems

ILSs are products that are created to provide distinct End Users according to their roles and authorizations. It also requires an authentication for them (End Users) like most systems. It has an interface that list items borrowable to them and ability to reserve items as well as to cancel items reserved. End Users may view reserved items, borrowed items, due dates and fines if any in the status page. They also have the privileges for account settings like passwords reset, profiles editing, and an interface to add to or delete books from staffs [20].

The Main component of an ILS

An ILS would have these main components:

Database Server used by ILS to perform data analysing, storing, manipulating, archiving and other non-user precise jobs [44].

Application Server allows application on program such as the MARC framework to be shared in an efficient, well-structured manner making functions easier [24].

Web Server handles HTTP request from client terminal to the application server and send back a response with an HTML page. It also delegates the changing feedback creation to other program for instance CGI scripts or server-side java scripts [36].

Client terminal is a serial computer interface that enables the input of data and display response from a web server. A terminal can either be a dummy terminal: a terminal that does not process any information. An intelligent terminal on the other hand does its own processing because of the microprocessor imbedded in it. The divergence of software into open source and proprietary meant a divergence in ILS's as well.

2. PROBLEM STATEMENT

Proprietary and open source software had stood the test of time in terms of deployment. The basic comparison is that proprietary software have proven to be stable but lacks in security, frequent update, discontinuation of software and number of concurrent End Users at the same time. On the other hand Open source lacks stability but is very secure, have good and frequent update, continuation of software and a large number of concurrent End Users at the same time. Recently, these two technologies are making up for their lapses in library services due to the available improvement technologies. The result of this has given birth to integrated library systems. This work assess the technical capabilities and cost of deployment of a proprietary or an open source ILS.

3. RESEARCH QUESTIONS

The study strives to react to the following questions:

Why Ghanaian libraries are uncomfortable to use open source ILS?

What are the distresses of Information Technologist and Libraries in relation to open source software?

Are there special expertise shortcomings in open source ILS that prevents Information Technologist and End Users from extensively exploiting them?

4. PURPOSE OF THE RESEARCH

The purpose of this research aims to explore the reason behind the unpopularity of open source ILS in Ghanaian libraries. The research would present a collation amongst the stipulations and functions offered by some of the dominant proprietary ILS software, and few of the regularly used open source ILS software. The consequences of the above collation should clarify the crucial distinction between proprietary and open source ILS software, and the technical influence on libraries that are contemplating in the use of open source ILS software. The motive of the study is defined as follows:

To explore the rationality behind why open source ILS software are unfrequently used in libraries.

To carry out an extensive collation between proprietary and open source ILS software packages.

Examine the distinction among proprietary and open source ILS software.

5. OBJECTIVE OF THE STUDY

The main objective of this research is to enable libraries to be able to make technical ad cost analysis based on this work as to which type of ILS when considered would benefit them now and in the future.

Specific Objectives

To examine the Knowledge and feeling of End Users, Administrators and Information Technologist regarding open source and Proprietary Integrated Library System concept.

To examine the technical standards of the system that are considered in choosing an ILS.

Perform a comparative analysis of core features between Proprietary and Open source ILS

6. SIGNIFICANCES OF THE STUDY

Due to the pervasive nature of information globally, a lot librarians in Ghana are automating their libraries but do not take into account the technicalities involved in choosing the right ILS for their libraries. This study is to provide a background knowledge into some of the technical aspects of some of the integrated library systems available and to enable librarians make better judgment in choosing the library system needed for their libraries.

7. LITERATURE REVIEW

Two types of ILS were discussed in this study; proprietary and open source ILSs. Two brands of each type of ILS was discussed. Proprietary ILS under investigation are Aleph and Millennium while open source ILS probed are Koha and NewGenLib.

Proprietary ILS are commercially written software which source codes are not made available to the public.

Millennium Integrated Library System: It's a web and Java built programmed library system that incorporates succeeding technology [28]. It is has a multi-layer user server structural design and uses Oracle as its database management system. Millennium present the following feature to users: authority control, a module that helps prevent duplication of bibliographic data and also checks redundancy. Acquisition module, enables libraries to purchase materials online. Cataloguing module where bibliographic details of materials are entered. Circulation module enables patrons to register and have access to materials available in the library. Millennium use the java (J2EE) platform which is three-tier architecture. The presentation and webserver layer is responsible for handling interactions with users. It also serves as the librarians interface but the webserver layer is integrated in this layer using Java web start. The business layer is responsible for performing any business processing (such as authentication, circulation, citations and discovery interface). This layer also interfaces with the data access services which is the where the MARC framework resides. The integration tier provides access to backend resource which includes databases and external systems. This tier also resides in the data access service layer of Millennium. The integration tier enables Millennium to integrate its Java platform with the Oracle database platform. The use of the three-tier architecture permits the content of every single tier to develop and change individually [8]

which employs the PL/SQL –procedural language/Sequential Query Language. The v6 of Oracle allows the integration of J2EE because of its Java plugin or container.

Aleph Integrated Library System: It's a Unicode-based ILS that provides multi-lingual and multiscript support interface. It's a product of the Ex libris group. It's easy to use and scalable [34] Aleph has the following features: Online public access catalogue which enables the pubic gain access to browse through a library's catalogue. Cataloguing module for entry of bibliographic details of materials in the library. Acquisition module holds the purchasing account details of a library. Circulation module enables patrons to register and have access to materials that patrons can browse. Aleph make use of the apache web server which is a powerful open source tool that enables webservers to serve web files on the network using hypertext transfer protocol, which provides a standard for server and client-side web browser to communicate [13] the apache used with aleph is customized version specifically complied for Ex libris products only. Aleph uses Oracle uses Oracle as its database server software. All operations on data in the database are performed using SQL statements since it is not actually known which version of Oracle Aleph uses one cannot determined how data manipulation is done [15].

Open source ILS: These are ILSs whose source code are made available to the public by its creator. Source codes are usually made available to the open source community and any changes or add-ons made to the source code by another person might not necessary be made open source too.

Koha Integrated Library system: It is a completely performed walkable library management system and its improvement is supported by libraries of different kind and sizes. Koha is completely coded in Perl programming language an established influential scripting language which uses style sheets to restrict how data is deployed. It also uses Java scripts within its pages. Koha has cataloguing, Circulation, Online public access catalog, a full acquisition module, serialization scheme aimed at newspapers and magazines. Koha is a two-tier architecture software. A client PC links straight to the server devoid of intervening apps. The questioning of Koha database as well as transactions are completed through CGI writings. Every processes occurs on the patron computer; the linking into the server is utilized solely for retrieving data utilizing the Apache web server to the MYSQL database server, two utmost widespread open source tools. Koha is developed for the Linux platform. It uses only one PC: its localhost and an organizational LAN or WAN and in coalition made through diverse latticed libraries through the network. It is programed to bring up-to-date and preserve net apps minus spreading and mounting software in possibly numerous patron PCs [8].

NewGenLib Integrated Library System: NewGenLib is entirely written in Java programming language with other Java related packages. NewGenLib has the following features: Circulation and borrower management: Manage patrons and their borrowing habits and enables the customer service department of the library to determine the borrowing habits of their patrons thus knowing materials that should be made available in huge quantities. Serials management: This module handle serials (which comes monthly, quarterly or annually), it cannot be catalogue as the normal books

and audios, therefore this module handle such materials. Cataloguing facility: It is in the module of the ILS where the bibliographic details of materials are entered. Details such as Title, call number, location, etc. It is flexible in describing ones search field and improved contents and communicating OPAC like obtainability of book jackets, Google preview, Comments / Book review, Tagging, Favorite reading list, etc. Zotero compliant OPAC: Enables the public access to browse through a library's catalogue when in need of a material.

 In the NewGenLib, the systems administrator is the one who has the privileges to set specific functional modules for the librarian and the interface provides several tabs for the functional modules. This enables to customize the user interfaces and several aspects of the functional modules such as the cataloguing templates using the MARC fields and subfields as well as others. It has an SRU/W server compliant and are searchable via SRU/W patron. NewGenLib operate using dispersed computers via a serve or network. Moreover, it may operate on LAN/WAN even when there is no internet connectivity and it assist well renowned, dependable and verified open source software modules [7]. NewGenLib is built on the "n-tier architecture" that is unbiased and runs on a server application, which is an intermediate among the patron computers and database server. [8]. Its presentation Layer/Web Server Layer uses the apache Tomcat is one of open source web server, is Java-based application [8]. In NewGenLib, the Tomcat server is embed in JBoss application server and a web container. The application layer use the concept of the application server trailed the victory the Java platform called Java-2 Enterprise edition (J2EE) earned. It takes advantage of the use of a mid-tier app server lead to numerous industry level application server. In the app server net units are "servlets" and "Java server pages" (JSP), while "business logic" is constructed into the "enterprise JavaBean" (EJB-3) [8]. Java server pages execute in a web container - these are equal of CGI scripts. NewGenLib's application server uses the JBoss Application platform for its application server. The database software employed by NewGenLib for its database server layer is PostgreSQL. PostgreSQL is an object-relational management system (ODBMS) built on POSTGRES version 4.21, established at the University of California at Berkeley [47] with stress on extensile as well as criteria acquiescence. A database server's main purpose is storage of data firmly as well as to permit recovery at the demand of other software applications. Postgresql runs on other platforms and on numerous operating systems [46].

8. METHODOLOGY

The theoretical research framework would be used in this study. The notion that proprietary ILSs are far better and improved is been carried by librarians in Ghana without proof as to why and if the derivation of such notion took in the backend applications of ILSs into considerations. This thesis project is considering not only the features of ILSs but also the applications, databases and programming languages these ILSs were written in, and comparing it to their open source counterparts. This research would use three probes to achieve the aims set above. The probes performed through online surveys. While the final probe would be conducted by comparison of technical aspect of open source software with the corresponding   proprietary   products. The probe would comprise of an investigation what would target

primarily on how the diverse groups consider the open source approach. The Candidates of the studies would be involved Information Technologist who have dealt or deals with ILS (that is either Administrators, End Users or Information Technologist).

The study comprises three groups of questions:

A close ended questions (yes, no or do not know) that would examine individual's Knowledge of the criteria established by the open source initiative for open source software and the selection criteria used.

A close ended questions (yes, no or do not know) that would assess how people feel about open source software in broad-spectrum.

A multiple choice and open-ended questions would discover which open source software people are really acquainted with, their previous experiences with open source software and the reasons that may motivate people to use open source software.

9. ANALYSIS AND DISCUSSION

The analysis of data collected as well as the discussions of the findings cover the knowledge of open source concepts, selection criteria for ILS and the comparison between open source and proprietary ILS

Findings from investigation 1 are in table 4.3.

Table 4.3: Knowledge and Attitude Dials for candidate groups

Candidate group	Knowledge Dial	Attitude Dial
Administrators	1.125	1.75
End Users(staff)	0.769	2.231
Information Technologist	2	3.136

Information Technologist were the utmost mindful and possibly to utilize open source software in their research.

Liberty to mount the software on limitless quantity of PCs were contemplated as the first inherent rationale for using open source software preceded by zero certificate charges as well as suppleness to alter the source code.

A small number of candidates of the end user group indicated problems they encountered with open source software concerning its usage.

Findings from investigation 2 are in table 4.5.

Table 4.5: Best 5 attributes for the user groups

ID	Features	Mark
1	ILS that could easily be integrated into the internal repository of the university would be preferred	141
2	A very important factor for selecting an ILS is licensing	150
3	An ILS that does not require extreme hardware and can easily work on the current hardware and infrastructure would be preferred	160
4	An ILS that has an installer does not need compiling and a lot of man hours setting up would be preferred	160
5	An ILS that displays and analyse data from a variety of data source or databases would be preferred	165

End Users usually have very high anticipations with reference to attributes they want to see.

Table 4.6 Comparisons between the types and brands of ILS

Features	Millennium	Aleph	Koha	NewGenLib
Server operating system	Windows	Linux	Linux	Windows, Linux
Staff client architecture	Java, Windows, HTML/Web	Windows	HTML/Web	Java, HTML/Web
Licensing	Yes	Yes	No	No
Cross-database searching	Yes	Yes	Yes	Yes
ERM Interoperability	Yes	Yes	Yes	Yes
Institutional Repository Integration	Yes	Yes	Yes	Yes
Open URL link resolution	Yes	Yes	Yes	Yes
Support for different web browsers.	Yes	Only IE	Yes	Yes
Provides examples of codes in the documentation.	No	No	Yes	Yes
Technical support	Yes	Yes	No	No
Documentation addressing different skill levels of Information Technologist	No	No	Yes	Yes
The server software requires extreme hardware and network gadgets	Yes	Yes	No	No
The server software has an installer and does not require compilation	Yes	Yes	No	No
The software require users to install additional plugins	Yes	Yes	No	No
The performance of software does not reduce though the quantity of users rises	Yes	Yes	Yes	Yes
Framework compatibility	No	No	Yes	Yes
Programming Languages	Java	Unicode	Perl, PHP, Python	Java

Database	Oracle (PL/SQL)	Oracle	MYSQL	PostgreSQL
Webservers	Java Web Start	Apache (Customized)	Apache	Apache Tomcat with embedded JBoss
Data exportation	No	No	Yes	Yes
Data Importation	No	No	Yes	Yes
Data transfer rate	undetermined	undetermined	14563.5546kbps	11650.8437kbps

10. CONCLUSION

The study begun with an aim to react the following research questions:

Why Ghanaian libraries are uncomfortable to use open source ILS?

What are the distresses of Information Technologist and Libraries in relation to open source software?

Are there special know-how shortcomings in open source ILS that prevents Information Technologist and End Users from widely using them?

This thesis begun with the speculation the open source ILS is competitive to its proprietary counterparts. The following conclusion were arrived:

The outcome concerning the knowledge dial demonstrated that administrators have little knowledge concerning the open source concepts. The attitude dial also shows that administrators have a negative picture about open source ILSs. The reasons for this attitude are:

You do not receive technical support when using open source ILSs.

Amateurs (those unpaid) created open source ILS.

With administrators who always have the final approval on the types of technology to use in ventures, the finding seems to prove the reason behind reduced acceptance of open source ILSs in libraries in Ghana.

The comparison conducted between the open source ILS and their proprietary counterparts shows that there is not much difference between the 2 types of ILS on the technical side. The findings could answer whether there are technical shortcomings preventing Information Technologist and End Users from widely using them.

RECOMMENDATIONS

It seemed from the findings of the study that administrators; the ones who have the capacity to affect the usage of open source ILS in numerous ventures are not completely concerned or well informed about the open source business model and do not know the benefits to be gain from it. Therefore, a greater publicity (such as seminars, exhibitions, training and support) need to be provide on the open source concepts and its features to administrators to meet their scope of interest.

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